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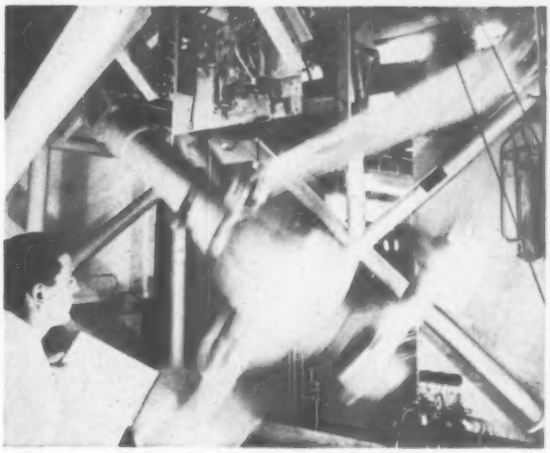

8,000 CYCLES. Structural integrity beyond that of any other transport aircraft was designed and built into the Boeing 707—and proved out in more than four years of prototype test-flying and ground testing of components. Landing gear, above, was put through 8,000 test operating cycles.

TORTURE RACK. A KC-135 jet transport-tanker recently completed a 15-month static test, culminating in a test-to-destruction to determine its absolute limits of endurance. During the test, loads were applied to force wing-tips through a 16-foot arc. Flaps, spoilers, engine mounts, rudder and other components all *proved* capability of taking far greater stresses than would conceivably be encountered in flight operations.

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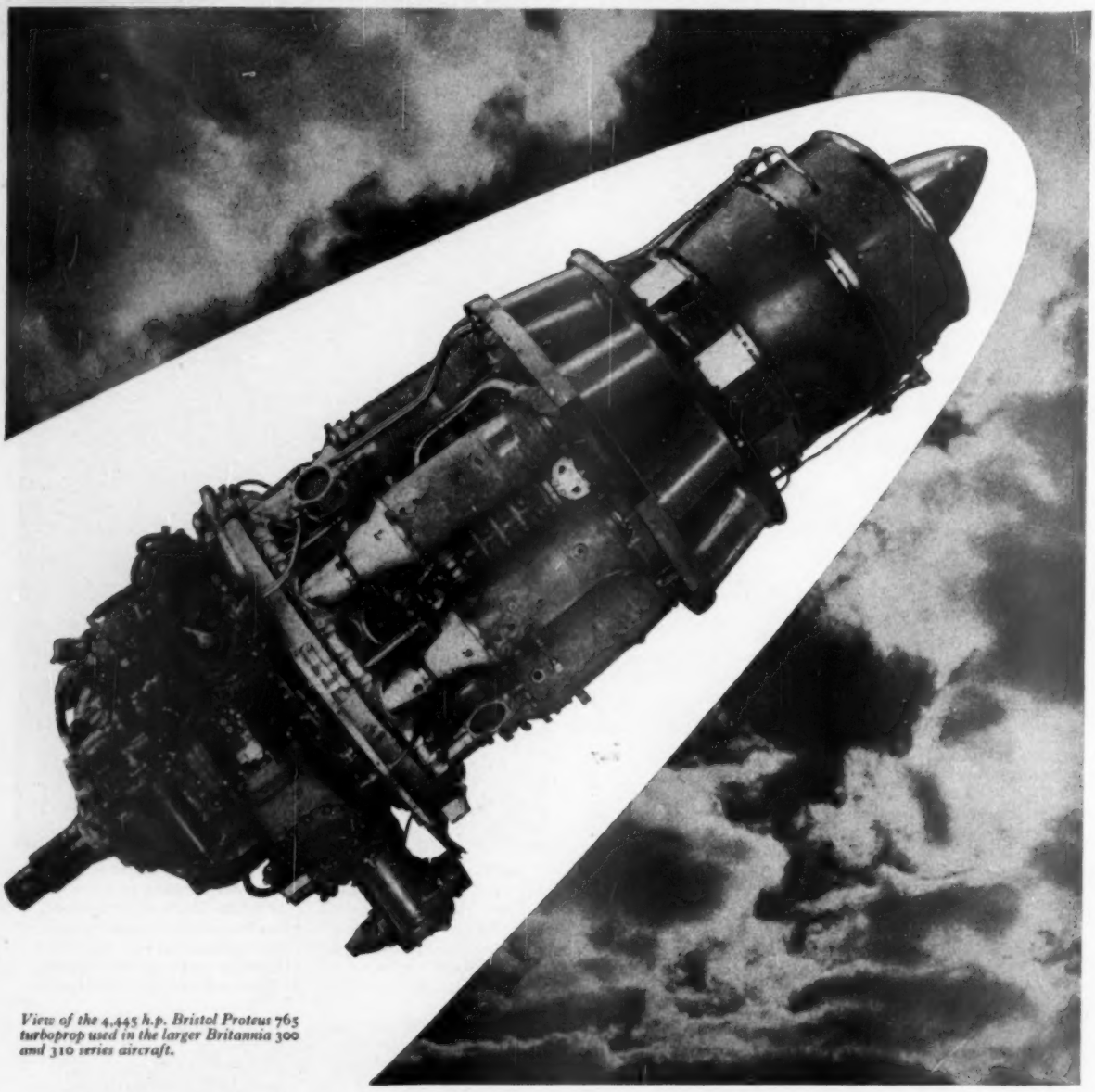

View of the 4,445 h.p. Bristol Proteus 765 turboprop used in the larger Britannia 300 and 310 series aircraft.

'Fluon' used in Bristol Proteus 765 turboprop engine

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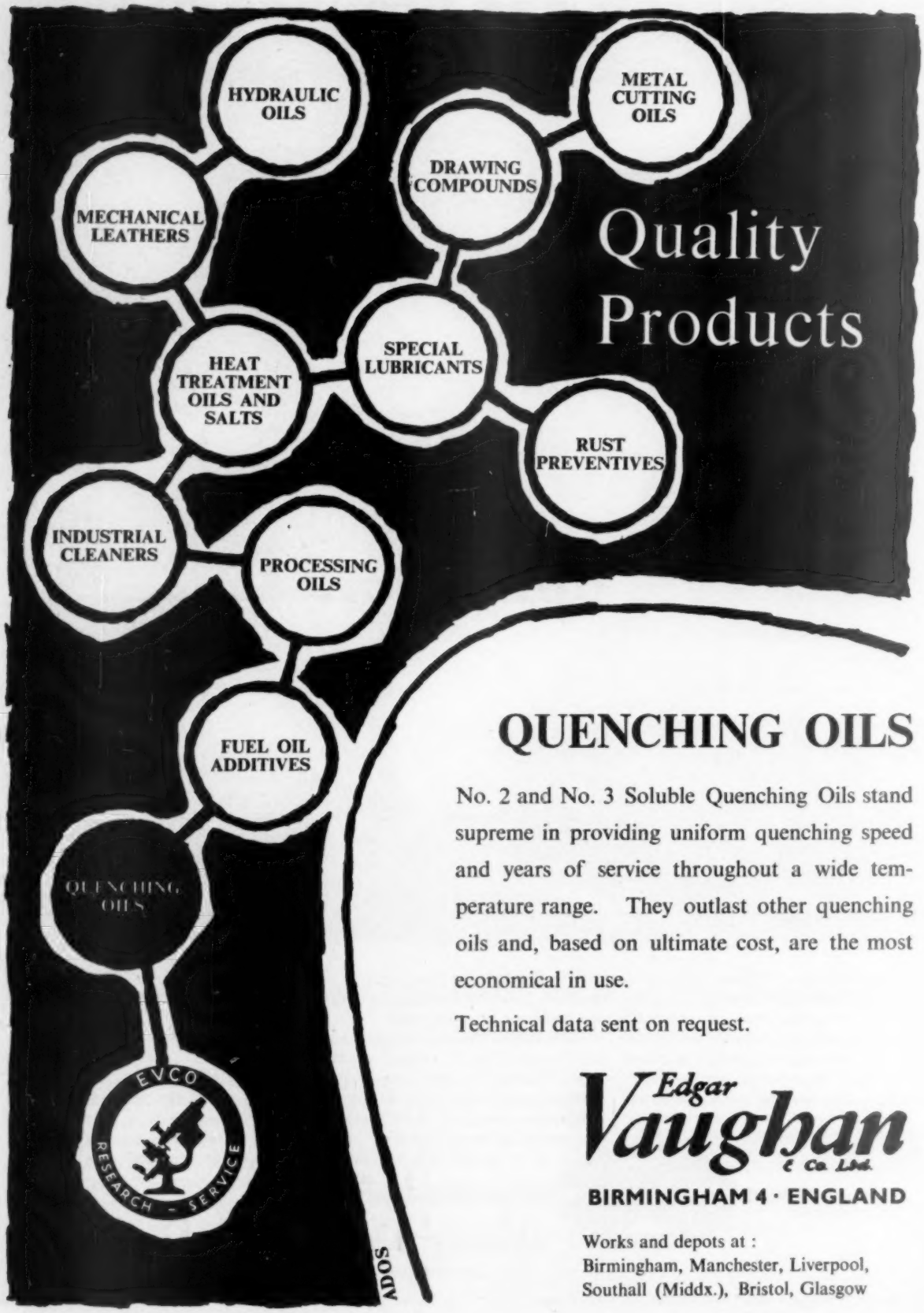

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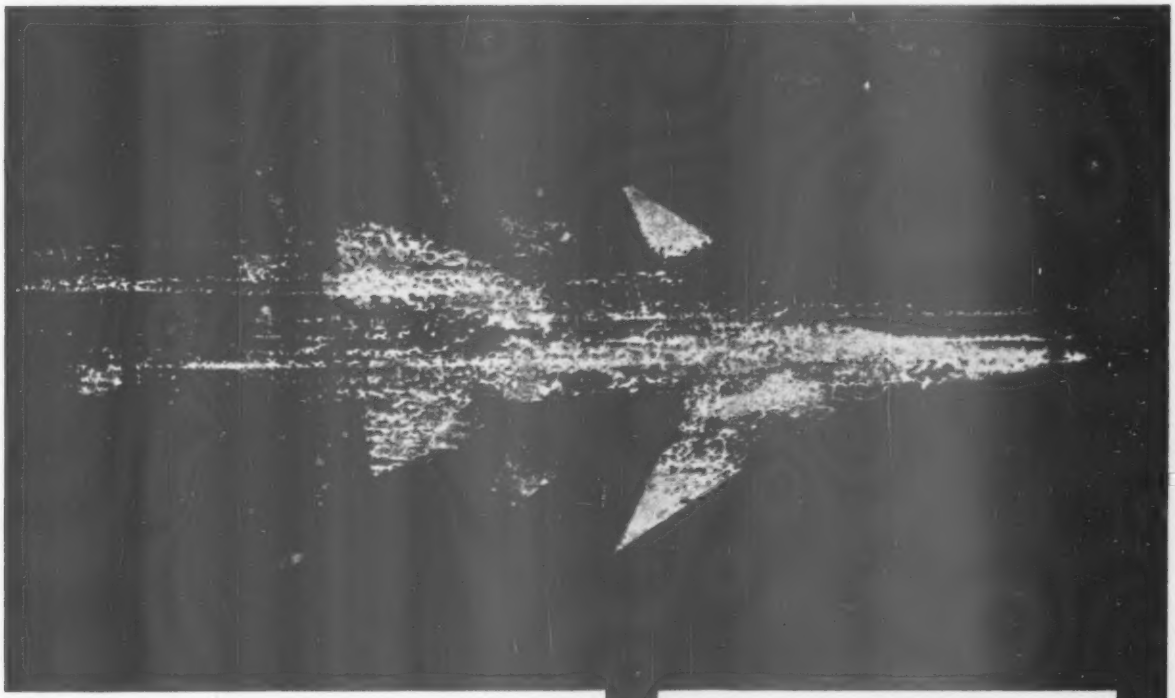

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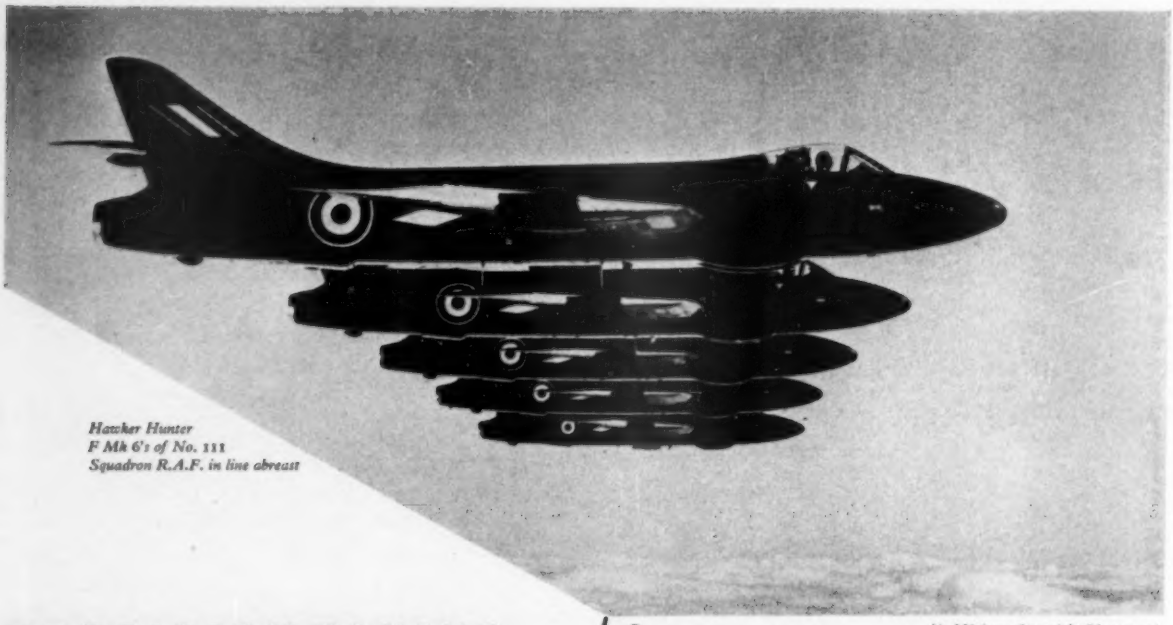

Hawker Hunter F Mk 6's of No. 111 Squadron R.A.F. in line abreast

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THE AEROPLANE

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Edited by - - THURSTAN JAMES

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NOW FOR LIGHT AEROPLANES

AT this moment when all the talk is of rockets and missiles and the struggle to be first to land on the moon, let us take a cue from those audacious folk, the crew of the free balloon "The Small World." Their story has been told with a wealth of picturesque detail in the paper which accorded them support. As an attempt to drift aerially across the Atlantic their effort was a failure. The fact that their deaths were not added to the list of those pioneers drowned in attempting to cross the Atlantic by aeroplane must be attributed both to their accumulated know-how of yachting experience and in particular to the skilful design and construction of the gondola of the balloon which demonstrated its seaworthiness in carrying four people some 1,800 miles. If the crew had acquired as much experience of ballooning before they started as they had of seamanship the story could well have been different.

The British salute adventurers of this calibre and their safe arrival has been warmly and widely welcomed. We see the exploit as an incitement to action.

There seems today a danger of it being forgotten that many of the air routes of the world were blazoned by light aeroplanes, light aeroplanes built in the United Kingdom and powered with British-built engines. Today the light aeroplane looms so slightly in the national mind that the closure of Croydon has aroused no widespread reaction.

The significance of the exploit of the crew of "The Small World" should be clear to those of us who believe that the low-powered flying machine has an essential part to play in the national life both in its economy and in its recreation. This adventure should open our eyes so that we might see what four people can do when they set their minds to it. This enterprising band of balloonists who had no real experience of ballooning, set to work and produced a convincing demonstration of the fact that there was something worth while in the theory of one of their number, the theory that the trade winds were so reliable that they would carry a balloon across the Atlantic.

If the belief is held, and there are plenty of people who say they hold it, that the light aeroplane is worthwhile, why do the supporters of this belief not band together and get something done? It has been demonstrated plenty of times that light aeroplanes are neither difficult to design nor expensive to build. As regards the supply of engines, the increasing freedom permitted our currency should mean that the purchase of a suitable U.S. powerplant should not be difficult.

How minimal the landing requirements of such craft can be has been demonstrated by the recent safe and successful forced landing of a light aeroplane at Wormwood Scrubs. How many of those who read the paragraph, we wonder, realized that the ground on which it alighted had been used by the early aviators?

We do not claim to be sated with sea-lore. We own, nevertheless, to a deep-seated belief that there was a time when the Naval Authorities in these islands refused to take seriously the activities of those who went down to sea in small boats. The little ships of Dunkirk and the activities of many other small ships and high-speed motorboats in the last War have settled that point.

But there is a danger which many old hands see and it is with all this talk of missiles and anti-missiles, tape-recording satellites and the like, the young people will feel that this flying business is terribly démodé; it is certainly no longer fashionable. And in this context it is amusing to recall that ballooning was once a diversion of the *haut monde* at Hurlingham and Ranelagh! With the fining down of the R.A.F. has come the introduction of the rocket to take over many of the duties of the interceptor; in view is the replacement of the V-bomber by the ICBM. There can be no surprise, therefore, if the potential pilot looks elsewhere for a future.

Yet none of us who have watched developments over the past two or three decades can have any doubts in our minds at all that pilots are always going to be needed. They will be needed for the mercantile air fleets as much as by the Fighting Services.

In the present gloomy depths of winter, then, let those who believe in flying for fun get together. They will find that there are a surprising number of people who are interested in building aeroplanes for them. Once this liaison has been established, it will be a less arduous business persuading the officials of the Ministry of Transport and Civil Aviation to make take-off and landing facilities available at prices people can afford.

No owner of a light aeroplane wants to use L.A.P. or Prestwick or Gatwick if it can be avoided. What he wants is a knowledge of approved and friendly grass fields widely and strategically placed with regard to the places one likes to fly to for fun. In this context it is worth remembering that, whether we like it or not, the first moves towards a more closely integrated federation of European nations have been taken. This must make for easier travel in Europe. And how better than to go places by lightplane?

Matters of Moment

More Rationalization

AS a move towards integrating more closely its aeronautical activities, the English Electric Group has formed a new company to take over research, design and development work associated with manned aircraft and guided weapons. This new company, which has an authorized capital of £6 million, will thus comprise the present English Electric aircraft division at Warton and Preston and the guided weapons division at Stevenage and Luton. It will be a wholly owned subsidiary of the Group and will be known as English Electric Aviation, Ltd.

This development is essentially a rationalization of the working arrangements of the parent Group's internal aviation work. It does not, therefore, affect the Napier company; and this other member-company within the Group will continue to operate as hitherto as a separate entity.

It will be noted that the new company's terms of reference are only related to research, design and development work; there is no mention of production. This, we understand, will come under the ægis of the parent company which will, in effect, act as a production sub-contractor to English Electric Aviation.

The board of directors of the new company will include Mr. H. G. Nelson as chairman and managing director; Lord Caldecote as deputy managing director; Sir George Nelson; Sir John Woods; Sir Conrad Collier; and Mr. F. W. Page. Sir Conrad Collier is the chief executive of the guided weapons division and Mr. F. W. Page, hitherto chief engineer of the aircraft division, has been made chief executive of this section of the new company.

So far as the general internal organization of the two sections is concerned, this will remain as it is at present. In future, however, the new company will be responsible for all contracts placed with English Electric for aircraft and guided weapons.

Britain's Satellite

SIR ARNOLD HALL said on January 7 that a Royal Society committee had recommended to the Government that a programme of launching small satellites was justified on purely scientific grounds. It was felt that the satellite was a very good scientific research instrument and that Britain should not remain aloof from basic research of this kind. The cost of launching small instrumented satellites could be kept within bounds by basing the programme on the military development of ballistic missiles.

This statement suggests that the Earth-satellite ball has now bounced back into the court of the Ministry of Supply—and of the Government. Mr. Aubrey Jones, the Minister of Supply, said in September that any use of the Black Knight research rocket as a satellite launcher was dependent on the value of such a project as assessed by the Royal Society.

Earlier statements on satellite launchings are attributed to Mr. Jones during his visit to Australia in August. He is quoted as saying that both the Black Knight and the Blue Streak LRBM could easily be adapted to launch a satellite. He said that the military significance of satellites was being investigated.

Contents of this Issue

MATTERS OF MOMENT 58
THE WORLD'S FASTEST VTOL AIRLINER 61
THE ARGOSY AIRBORNE 62
AIR TRANSPORT 64
BRISTOL SALES ENGINEERING 66
PRACTICAL TURBOJET OPERATING PROCEDURES 67
THE FIGHTING SERVICES 69
PROGRESS REPORT ON THE MAGISTER, by John Fricker 70
LOCKHEED JETSTAR—In Production with Bristol Engines 72
NEWS OF INDUSTRY 76
NEW WORLD PHOTO-NEWS 77
DESIGN FOR HELICOPTER SAFETY 78
NEWS ITEMS 79
PRIVATE FLYING AND GLIDING 82
CORRESPONDENCE 83
WREN'S WROUNDABOUT 83
NOTES AND EVENTS 84

ROTODYNE'S FASTEST.—Mr. G. W. Hall, chairman and managing director of Fairey Aviation congratulates Sqn. Ldr. W. R. Gellatly, the company's senior rotary-wing pilot on his successful record attempt with the Rotodyne over a 100-km. closed circuit. As recorded in more detail on page 61, the Rotodyne's speed was 190.9 m.p.h.

With this background a clear statement of British policy on satellite launchings cannot long be delayed. The Royal Society is in favour on scientific grounds and few can believe that satellites have no military value. It is unfortunate that there is no overall authority responsible for satellite plans; at present it appears that the Royal Society is responsible for satellite and high-altitude rocket instrumentation, while the Ministry of Supply has the task of raising the instrument payloads into space. This has been the case with the I.G.Y. Skylark programme of high-altitude rocket firings, and the procedure may well be perpetuated in any satellite programme.

One fact should not be forgotten—Britain has, so far as is publicly known, only launched a single Black Knight to date, and no Blue Streaks. Neither rocket is likely to be sufficiently developed or available for scientific satellite launchings for many months. It seems unreasonable to expect that any British satellite could be launched in less than a year or two—unless the military and national-prestige value of such a launching is considered sufficient to withdraw some Black Knight or Blue Streak rockets from the development programme.

Should Britain's first aim be a satellite or a fully-developed ballistic missile? With American Thors already in position in East Anglia many may feel that a British satellite should take priority over a British ballistic missile.

Avro's New Airliner

EARLY next year is the target date for the first flight of the Avro 748, a short/medium-haul airliner announced last week. The go-ahead for development of the new type, to be powered by two Rolls-Royce Dart turboprops, has been given to the Aviation Division of Hawker Siddeley by the Group management.

Sir Roy Dobson, managing director of the Hawker Siddeley group of companies, has said that Avro have been considering the potential market at home and overseas for this type of airliner for some time and "have already done a great deal of preliminary work on this project."

Only details of the Avro 748 given so far are that it is to be a pressurized 36/44-seater powered by two Darts of unspecified

type. In view of the Hawker Siddeley Group's known interest, a year to 18 months ago, in the possibility of producing the Aviation Traders Accountant, however, the similarity between the Avro 748's specification—and, we understand, its general appearance—and that of the Accountant is interesting. Although the Avro 748 is an entirely new design, the company's interest in this market is a continuation of the earlier investigations into this type of aircraft.

Potential customers for the Avro 748 may be found in India where the Indian Air Force has a requirement for a Dakota-replacement and the internal carrier, India Airlines Corpn., also wishes to replace its fleet of DC-3s. In this case, production would probably be undertaken by Hindustan Aircraft, Ltd., in Bangalore. For this contract, and it seems, most others, the Avro 748 will be competing with the Fokker Friendship, already well established in production on both sides of the Atlantic, and the Handley Page Dart Herald, which is also available.

Delay for the Vanguard

MAIDEN FLIGHT of the Vickers Vanguard was delayed when one of the Rolls-Royce Tyne engines ran roughly during ground trials. On examination it was discovered that brazing metal had blocked an oil supply line, which resulted in the failure of two bearings.

The other three Tynes of the first Vanguard were also stripped down, but were found to be in perfect condition. A complete set of Tynes was due to be available again at Weybridge by today.

P.531 Production Plans

SAUNDERS-ROE, LTD., is to build as a private venture a batch of Mk. 1 P.531 five-seat helicopters. This decision has been taken following successful development trials with two prototypes. The production aircraft will be built for use in military rôles; it is expected that their selling price will be less than £30,000 each.

The two prototypes have Blackburn Turmo free-turbine engines derated to give 300 s.h.p.; the Mk. 1 production aircraft will have Turmos with a 425-s.h.p. 1-hr. rating. The P.531 has been designed to operate in a range of military rôles for liaison, air/sea rescue, casualty-evacuation and reconnaissance, or as a light freighter, trainer or weapons carrier.

Development of the P.531 beyond the Mk. 1 version is likely; in this case a shaft-turbine engine in the 1,000-h.p. class would be installed, but it would be derated to give about 600 s.h.p. for temperate operation. The airframe, transmission and rotor systems of the P.531 have been designed to take powers up to 650 s.h.p. The reserve power of the derated 1,000-s.h.p. engine would ensure that 600 s.h.p. was available even in hot high-altitude conditions, and the helicopter's performance would thus be maintained virtually regardless of climate and geography.

TAXI TRIALS.—On January 6, the Convair 880 made its first taxi runs at Lindbergh Field, San Diego. Four runs were made at speeds up to 80 m.p.h. The 880, scheduled to fly at the end of this month, is now undergoing a nine-day ground resonance test programme.

After Thirteen Years' Service

THERE will be widespread regret at the news contained in the most recent issue of the *Royal Aero Club Gazette* that Col. R. L. Preston's request to relinquish his appointment as secretary - general of the Royal Aero Club as from April 30, 1959, has been accepted by the committee of the Club. However, it is good to know that, as from May 1, 1959, Col. Preston has accepted the position of honorary secretary-general; in this way his experience and ability will not be lost to the Club and when required he will represent the Club on international and national committees as well as attending various Club committee meetings

Certain staff reorganization has already been made at the Royal Aero Club, and in future correspondence relating to aviation matters should be addressed to the aviation secretary (Mr. M. O. Imray) at the Royal Aero Club Aviation Centre, 19 Park Lane, London, W.1, and club and house matters to the house secretary (Mr. W. Marsden) at 119 Piccadilly, London, W.1.

Seeing that luckily the world of sporting-flying and international events is not to lose the familiar and genial figure of the secretary-general of the Royal Aero Club, we do not propose to write what the late Charles Grey used to call a "vivatuary." We shall content ourselves with saying "thank you" not only on our own behalf but also on behalf of members of the Royal Aero Club, for all that "Mossy" has done for us all during his 13 years of service, first as secretary and then as secretary-general. We should, indeed, be remiss if we did not include in this expression of gratitude for work on behalf of the R.Ae.C. the name of his charming wife, Mary.—T.J.

Wilfrid Broadbent Retires

HAVING completed 42 years' continuous service with the Fairey Aviation Co., Ltd., Mr. Wilfrid Broadbent has retired at the age of 68.

He first went to Faireys in 1916, when the company was building the Campania flying-boat and the little Hamble Baby seaplanes for the Navy. As works manager he was responsible for the production of all early Fairey designs and planned and supervised the building of the present Fairey factory at North Hyde Road, Hayes, which eventually absorbed the former plant at Clayton Road.

In 1929 Wilfrid Broadbent was appointed a director of the company. He had then been associated with such types as the Atalanta, Titania, Pintail, Flycatcher, the III series, Fawn, Freemantle and Ferret, having steered the company through the design change from wood to metal. Two years later he played a major part in establishing the Belgian subsidiary, Avions Fairey, at Gosselies, for the building of Fox and Firefly biplanes for the Royal Belgian Air Force. He became a director of Avions Fairey in 1934.

The purchase and initial supervision of the former Willys-Overland-Crossley factory at Stockport for the 1935 expansion programme were his responsibilities, and during the Second World War he planned and equipped the Fairey shadow factories at Errwood Park, Stockport, and Ringway. After the War he negotiated the agreement for the company to buy the Heston works from the Government and equipped it for guided-missile research, development and manufacture.

His experience has thus covered aircraft production from the earliest types to the present-day Rotodyne.

Joining Hawker Siddeley

SIR HALFORD W. L. REDDISH, F.C.A., has accepted an invitation to join the board of the Hawker Siddeley Group; as a well-known industrialist, his advice will certainly be sought on matters associated with both the aviation and industrial divisions of the group.

Aged 60, Sir Halford is chairman and managing director of the Rugby Portland Cement Co., Ltd., and of its subsidiaries. He is a member of the Scottish Union and National Insurance Co. (London Board) and of other concerns, and a Freeman of the City of London in the Livery of the Pattenmakers.

"The Small World's" Flight

CONGRATULATIONS have very properly been widely forthcoming for the crew of the balloon "The Small World," Mr. Arnold Eiloart, Mr. Timothy Eiloart and Mr. and Mrs. Colin Mudie, who arrived at Barbados in the West Indies on January 5, as we briefly reported last week. Their 3,000-mile crossing of the Atlantic had been accomplished in 24 days. Only the first 1,200 miles, however, were covered, according to the story in the *Daily Mail*, in the air. The balance was done in the most ingeniously designed gondola which served as a lifeboat and in the hands of the experienced yachtsmen who formed its crew brought them safely to land at Crane Beach, some 13 miles from Bridgetown, Barbados.

The balloon left Teneriffe in the Canary Islands early on the morning of December 12 and all went according to plan until just before midnight GMT on the third day out. Then the crew were forced to cut the balloon loose from the gondola after having to ditch during a storm.

The capacity of "The Small World" is 54,000 cu. ft. (1,529.11 cu. m.), which puts it in F.A.I. Class A-6 (1,201-1,600 cu. m.). Records in this category are: Distance, 2,766.814 km. (1,719 miles) set up by Russia in 1941. Duration, 69 hr. 20 min. —same flight as above.

The greatest distance covered by balloon, according to the F.A.I., is 3,052.7 km. (1,896 miles) set up by Germany in 1914; the greatest duration is 87 hr. (Germany), 1913. Both these records were set up by balloons in Class A-10 (4,001 m. and over).

Lord Ventry writes:—

It is quite usual after quite an ordinary free run in a balloon to hold a sort of inquiry to see how things could have been managed differently, and it is obvious the gallant crew of "The Small World" would do the same. Looking at the whole thing from a distance, and with no experience whatever of semi-tropical ballooning, I think that a reliable gas thermometer to enable the crew to calculate and look out for superheat would have been useful, especially if lift tables could have been worked out beforehand. They might then have had some idea of how much gas or ballast would have to be let go to achieve equilibrium.

It was also a pity that Wg. Cdr. Booth, and Mr. Long could not have had a real opportunity for a proper "ballasting up" before take-off. They could, perhaps, have worked out the approximate height at which the first run-down would take place, and so saved ballast. It was a great pity too, that the crew had had no chance of testing their method of collecting water ballast, and perhaps a deeper knowledge of balloon theory or aerostatics would have been worth while.

They were extremely unlucky in being caught in such violent thermals, and perhaps they have picked up some useful meteorological data.

As a free balloon lacks all dynamic control and lift, it may be that they tried to do the impossible. But much must have been learnt, and all will surely sympathize with them for not achieving their end. It was at least a very sporting and plucky attempt.

Soviet Spaceman is Ready

PROFESSOR ANATOLY BLAGONRAVOV, one of Russia's leading lights in the world of astronautics, recently revealed in a telephoned interview (according to a South African newspaper) that the Soviet Union was grooming a man for spaceflight. The candidate selected, out of over 1,000 applicants for the post, is said to be Ivan Igorsky, 30 years old, 6 ft. 2 in. in height and weighing 12 stone 12 lb.

It is not very clear from the conversation for what destination the well-built Igorsky is being prepared. Prof. Blagonravov went on to add that ". . . Russia planned to launch manned rockets to Venus, Mars—and possibly the Moon—in September this year." "Our idea," he said, "is to establish a New Russia on the planets Venus and Mars. We have done all that is necessary, and are now preparing to land a rocket on Venus in June. The main object of our experiments is to be the first on the Moon."

No doubt the Soviet women scientists will be much put out by this announcement, since it was clearly stated some time ago that women are physically better adapted for the rigours of spaceflight than men. No one since has dared to disagree with this view, except possibly Mr. Igorsky. And he couldn't care—being a bachelor.

On the other hand, this prophecy of omnidirectional eruption into space on the part of the Soviet Union is no doubt attracting close scrutiny in the Pentagon. The spectacle of Russians calmly setting up lunar bases on what has always been regarded as United States territory will indeed be distasteful to the Americans.

The next Thor or Jupiter probe due out (early February) from Cape Canaveral, had better take along a flagpole and a tape recorder. On impact a tape-recorded message may then radio that it has taken possession of the Moon, and formerly annexed it as the 50th State of the Union. It will then break into the strains of "Broadway Melody," and the Stars and Stripes will be run up. That should fix the Russians.

The alternative will be the dismal prospect of collectives all along the Martian canals, filled with Volga Venusians. Already there is a strong rumour circulating to the effect that the capital of Mars will be called "Marscow."—I. G. WHY.

Harry Delacombe

AS we go to press we learn with regret that Lt.-Col. Harry Delacombe, who, as recorded on page 81, was recently a director of Jablo Plastics Industries, Ltd., died at Brighton on January 10.

Nearly all of his long life was spent in close association with aviation. Having served in the Royal Navy from 1886 to 1892, he later became *The Times*' air correspondent; was a founder-member of the R.Ae.C. and officiated at the early flying meetings, and was concerned with the Bristol and Armstrong Whitworth companies. During the First World War he was associated with kite balloons and was later Assistant Director of Air Organization at the Air Ministry.

The World's Fastest VTOL Airliner

WHEN the Fairey company announced last week that their Rotodyne—powered by two Napier Eland shaft turbine engines, and flown by Sqn. Ldr. W. R. Gellatly—had set up a 100-km. closed-circuit World Class record, another significant point was added to the development curve of rotary-wing aircraft generally. As we briefly recorded in our issue for January 9, the Rotodyne achieved a speed of 190.9 m.p.h. (307.22 km.p.h.) on January 5; a speed that is, of course, subject to official confirmation by the F.A.I. The flight was, in fact, the 164th made by the Rotodyne and it has since done several more bringing its total flying time up to something like 60 hours.

As an indication of the aircraft's potential performance this was noteworthy enough—but it is the more remarkable when one is reminded that the speed achieved represents no less than 29 m.p.h. more than the existing absolute "straight line" speed record for helicopters. Another point to bear in mind is that the Rotodyne's performance over the 100-km. course was accomplished using no more than the maximum cruising rating of the powerplant.

Naturally enough, thoughts on possible record-breaking attempts had been in the minds of the Fairey rotary-wing team for some time. But up to the present the primary need had been to get on with the preliminary development flying of the aircraft and the distractions caused by a record attempt could not be entertained. Quite recently, however, the Rotodyne reached a stage in its development programme which made this a more reasonable proposition and it was felt too that the time was ripe for some positive and convincing demonstration of its capability of meeting the brochure performance.

Initially, consideration was given to an attempt to set up an absolute speed record. There were, however, two arguments against this proposal. First, there was the difficulty of actually measuring the speed to the degree of accuracy demanded for such an attempt by the F.A.I.—over an open straight-line course. This meant that ordinary "stop-watch methods" could not be used and the only alternative was to borrow the complex Farnborough apparatus used by the R.A.E. for the Fairey Delta speed record.

The second—and, perhaps, the more real—difficulty was that for an all-out straight-line speed attempt, the powerplants would need to be operated at their emergency power, with the inevitable wear and tear. As, at present, there are only two Rotodyne engines available, it was felt that this treatment was not justified with so much more important development flying still to be done.

A closed-circuit record, on the other hand, can be timed with the usual stop-watch system. Moreover, a very useful record well above the existing helicopter record could be set up using no more than cruising power—and this, it was felt, was a more practical demonstration of the Rotodyne's operational performance as an inter-city VTOL airliner.

Once it had been decided to attempt a closed-circuit record, much thought was given to a suitable course. This can, under the rules, be any desired shape—the only stipulation being that the starting line and finishing line are coincident. For obvious reasons, White Waltham was selected as the main operating point upon which to base the course, and a railway bridge over the Western Region tracks alongside the aerodrome was chosen as the actual starting and finishing line. The selected course was almost a straight out and return run, but could more properly be described as a greatly elongated pear shape with a wide-radius 180° turn in the neighbourhood of Hungerford.

Ground observation was the responsibility of the Royal Aero Club who were represented by Capt. Hubert Broad, Mr. Maurice Imray and Mr. R. R. Stephenson. The timing was in the experienced hands of Philip Mayne.

The run was planned to be at a height below 1,000 ft. to help the crew to keep accurately on course and also to aid the ground observers at the Hungerford turn. The run was, in fact, started at 650 ft. and finished at 750 ft. (One of the prime requisites for such a record attempt is that the aircraft must not dive on to the starting line and must not cross the finishing line at a lower altitude than the starting altitude.)

The Rotodyne was flown at an all-up weight of 32,800 lb. which is slightly less than the present normal maximum weight. (This is 33,500 lb. which with the current 2 x 2,800 s.h.p. delivered by the Elands is equivalent to the design 39,000 lb. all-up weight corresponding to the developed 2 x 3,500 s.h.p. Elands). A crew of four was carried and comprised Sqn. Ldr. W. R. Gellatly with Lieut. Cdr. J. G. P. Morton as co-pilot; Dr. D. B. Leason as powerplant observer and Mr. E. J. Blackburn as strain-gauge observer. As we have already mentioned the powerplants were operated throughout the run at the 1 hr. continuous rating, so that the measured performance was a true representation of the cruising capability.

On the basis of the power used and speed achieved it seems fairly clear that the Rotodyne could easily accomplish a comfortable 200 m.p.h. using maximum power. It is, incidentally, interesting to note that as the record attempt was to be in the new convertiplane category, evidence had to be provided to show that during the run no power had been supplied to the rotor. This was done simply by a photographic record of the blade duct pressure gauges.

A recent external change noticeable on the Rotodyne is that its upper tail fins are now vertical instead of being sloped outward at 60°. The upper fin area is necessary for directional stability but it would appear that the chosen inclination to the vertical had given too much dihedral effect and that this has had to be reduced by bringing the fins upright. They are still capable of movement when the aircraft is on the ground so as to give clearance for the drooping rotor blades.

RECORD MAKERS.—In this group at White Waltham are included the pilots, flight observers, Royal Aero Club representatives and members of the ground crew—all of whom contributed to the Rotodyne's notable success in setting up a new 100-km. closed-circuit speed record of 190.9 m.p.h. on January 5.

The Argosy Airborne

FIRST FLIGHT of the Armstrong Whitworth A.W.650 Argosy was on January 8; the first aircraft of 10 being built, G-AOZZ, took off from Bitteswell at 11.44 hr. on that date and flew for 62 min.

The chief test pilot, Eric Franklin, reported that all went very well and several tests were made before landing. He was accompanied by Bill Else as second pilot, and by flight-test observer Roy Hadley and flight engineer Kenneth Oldfield.

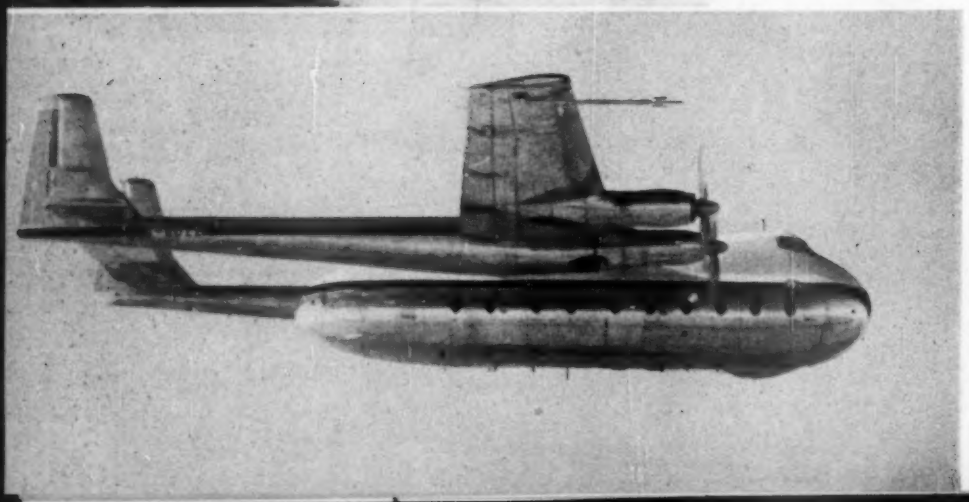
The Argosy (fully described with a cut-away drawing in our issue for November 21, 1958) thus made its first flight 26 months after the go-ahead was given for its development and 23 months after issue of the first drawings.

It is being developed entirely as a private venture by Hawker Siddeley, who have so far put £10 million into the design and production of the first 10 aircraft and two structural test airframes. A few days before the Argosy's maiden flight it was announced that the military version, the A.W.660, is to be ordered for the R.A.F.—probably about 24 aircraft (equipment for two squadrons) at first.

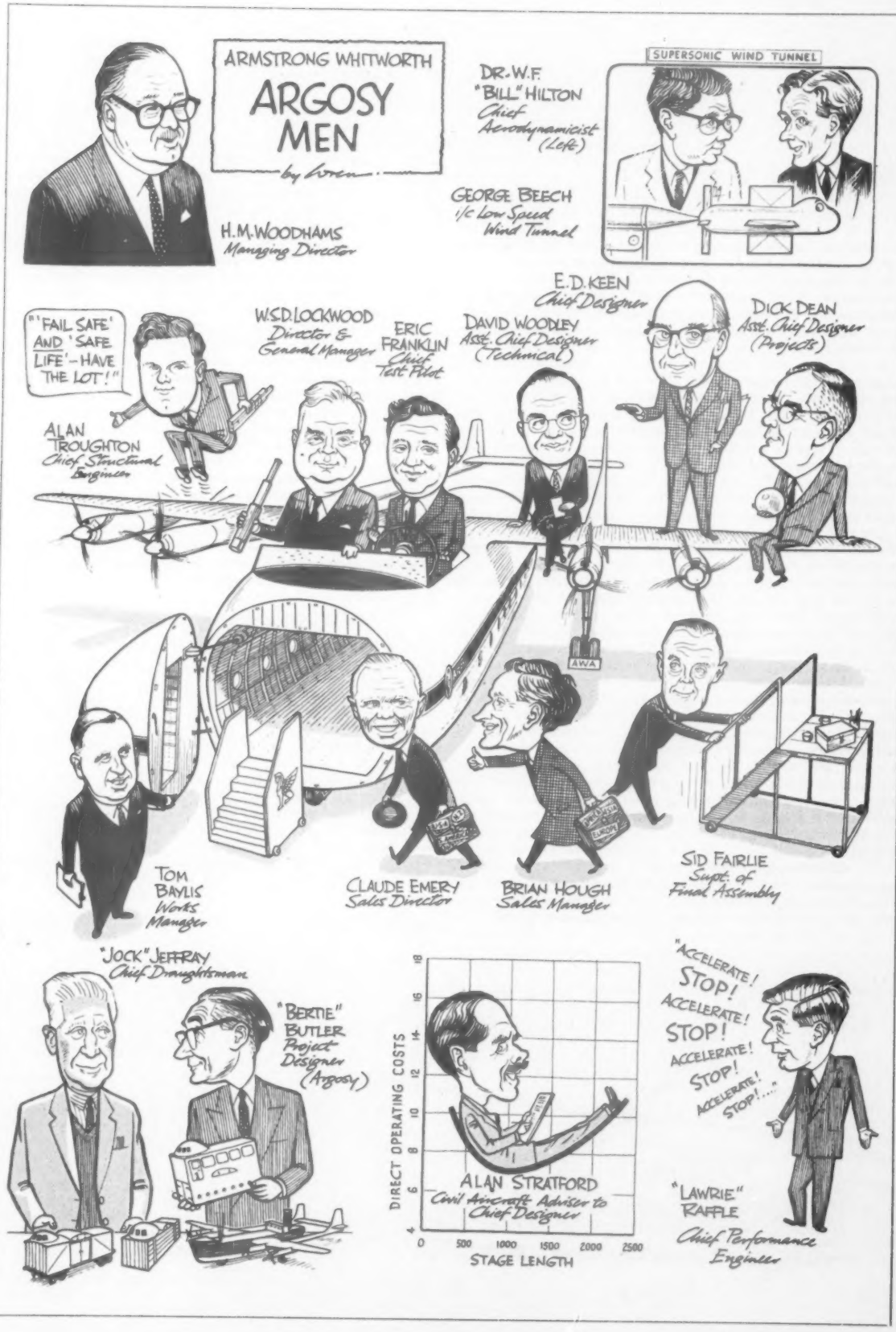
Like the A.W.650 Argosy, the military A.W.660 has four Rolls-Royce Dart R.Da.7 turboprops, but at a higher military power rating than the 2,100 e.h.p. of the Mk. 526. It also has a similar fuselage-nose loading door for the freight hold, but at the rear has a special "crocodile-tail" door with integral loading ramp and provision for air-dropping of supplies. The fuselage floor is strengthened for military vehicles, and there are two paratroop-dropping doors in the fuselage sides near the tail.

The Argosy has a gross weight of 82,000 lb. and a maximum no-reserves payload of 28,000 lb. for a range of 600 nautical miles or 20,000 lb. for 1,400-mile range. The wing span is 115 ft. and the length is 86 ft. 9 in. The first three aeroplanes will be used for airworthiness certification by the A.R.B. and the fourth Argosy is due to set off on a demonstration tour in about six months' time. Full A.R.B. and C.A.A. approval should be obtained by mid-1960.

Later production versions will doubtless take advantage of higher-powered Darts and embody some stretch in capacity. In this context it should be noted that the Dart R.Da.10 has already completed a type-test at 3,200 s.h.p. military rating (with water-methanol) for take-off.



Top left, Argosy aircrew on the first flight on January 8: Left to right, Eric Franklin, chief test pilot; William (Bill) Else, assistant chief test pilot; Kenneth Oldfield, flight engineer; and Roy Hadley, flight-test observer. Left, a profile of the Armstrong Whitworth Argosy shows its functional, but not unpleasing, lines.


ARMSTRONG WHITWORTH
ARGOSY MEN
by Wren
H.M. WOODHAMS
Managing Director
DR. W.F. "BILL" HILTON
Chief Aerodynamicist (Left)
GEORGE BEECH
i/c Low Speed Wind Tunnel
SUPERSONIC WIND TUNNEL
E.D. KEEN
Chief Designer
DICK DEAN
Asst. Chief Designer (Projects)
DAVID WOODLEY
Asst. Chief Designer (Technical)
W.S.D. LOCKWOOD
Director & General Manager
ERIC FRANKLIN
Chief Test Pilot
"'FAIL SAFE' AND 'SAFE LIFE' – HAVE THE LOT!"
ALAN TROUGHTON
Chief Structural Engineer
AWA
TOM BAYLIS
Works Manager
CLAUDE EMERY
Sales Director
BRIAN HOUGH
Sales Manager
SID FAIRLIE
Supt. of Final Assembly
"JOCK" JEFFRAY
Chief Draughtsman
"BERTIE" BUTLER
Project Designer (Argosy)
DIRECT OPERATING COSTS
4
6
8
10
12
14
16
18
0
500
1000
1500
2000
2500
STAGE LENGTH
ALAN STRATFORD
Civil Aircraft Adviser to Chief Designer
"ACCELERATE! STOP! ACCELERATE! STOP! ACCELERATE! STOP! ACCELERATE! STOP!..."
"LAWRIE" RAFFLE
Chief Performance Engineer

Air Transport

Compromise or Rate-war?

ALTHOUGH some cynical observers of the airline scene are inclined to nurse a secret hope that the present turbojet fares deadlock will lead to an open-rate situation—thus letting a little fresh air into the business—others are all too well aware that the resulting confusion would lead only to large-scale Government interventions and negotiations. Maybe, they say, a free-for-all would be to the advantage of the travelling public, but such a situation would never be allowed to develop—the Governments would step in, make their own bilaterals and pricing freedom would be more restricted than ever.

In fact, nobody appears to believe that the members of the International Air Transport Association—with a rate-war or Government intervention thus hanging over their heads—will really fail to reach a compromise agreement before the deadline of March 31.

After a four-week tussle in Cannes last September-October the problems of turbojet differentials and of certain other fares and rates were postponed to another session to be held in Paris early in 1959. Following, it is believed, a recent meeting in London between representatives of Alitalia—one of those strongly in favour, at Cannes, of a fare differential or surcharge for the turbojets—and of B.O.A.C. and Pan American Airways—who were equally strongly not in favour—the full-scale discussions on fares and rates over the North Atlantic have again been postponed.

These are now to be held during the early and middle period of February in two separate sessions. The first will be devoted to the North Atlantic passenger fares and commodity freight rates, and the second to the outstanding questions of European fare levels and inclusive tour arrangements.

So far as Europe is concerned it is believed that B.E.A. will ask for a considerable reduction (possibly up to 15%) in existing tourist fares, making, in effect, the European tourist standards and fares more or less equivalent to those of the North Atlantic economy class. At the time of the Cannes conference, European traffic was only just recovering from its recession and the need to attract a new market by a fare-lowering exercise was probably a fairly popular one. If this were so—and the traffic conferences are private (with a tough fine for any airline which leaks information) so that the onlooker can be informed only by means of gossip—the climate might possibly have changed in the meantime. But it seems unlikely that a lower tourist fare will be seriously resisted in a World environment in which the trend lies towards the application of any means by which new travel markets can be tapped.

The difficulties over B.E.A.'s stated wish to carry inclusive tour passengers on a fill-up basis on certain off-peak services (see THE AEROPLANE of November 7, 1958, p. 676) appear to have been the resistance of the British independents and, so far as the outsider can understand it, the fact that such a plan means the need within IATA to revalidate a charter agreement. Naturally the British independent IATA members resisted the B.E.A. proposals. Since Cannes, it is believed, there has been a change in the attitude (or, at least, in the official attitude) of the independents and the B.E.A. plan, in one form or another, can be expected to go through without serious opposition.

No such probably happy conclusions can be seen in relation to the turbojet fare problem. A compromise solution must, and presumably will, be reached, but it is difficult to see how this will be possible if both sides remain adamant. An obvious possibility could be some attractive offer to the differentialists in exchange for their support of the anti-differentialists.

The large-scale turbojet operators—who are obviously not in favour of any fare change which would reduce turbojet traffic—might, for instance, agree to a lower overall fare structure for specified piston-engined equipment. This would help to keep such equipment in profitable service until it can finally be written off at zero value and might not, if the fares are very carefully gauged, reduce seriously the traffic for the more attractive turbojets.

Such a solution would, however, leave the turboprops out in the cold, since their operators would then lose both to the swings and to the roundabouts. Yet it seems almost an impossibility that the turbojet operators would let the turboprop operators get away with some of their prospective traffic—and certainly not unless B.O.A.C., the largest user at present of long-haul turboprop equipment, is prepared to fight for the future of this category of aircraft.

IATA and Automatic Landings

DURING the discussions at the International Air Transport Association's technical conference in Monte Carlo last September, operators' representatives, manufacturers and research organizations agreed that automatic approach and landing systems would certainly come into use eventually with the airlines.

A report now being circulated by the Association's technical department makes the comments that the time-scale for the introduction of such systems depends on the amount of effort and research time devoted to the problems and that the objective of reliable routine blind landings is likely to be reached through an evolution of present devices rather than by any revolutionary new departures. The systems developed, incidentally, by the British Blind Landing Experimental Unit (see THE AEROPLANE of October 17, 1958, pp. 591-593) and by Bell in the U.S.A. both make use of developments of existing aids and systems.

We hope to deal later with the IATA report in more detail.

RECORD-MAKER.—This new photograph of the Fairey Rotodyne shows the modified tail in which, as explained on page 61, the upper fins are now vertical instead of being sloped outwards at 60°. As related in last week's issue (page 30) B.E.A. has stated its intention of ordering a developed version of this aircraft.

ISLAND TERMINAL.—A view of the new airport building at Luqa, Malta, from the air side, showing the pier and waving base, with public restaurant behind, and freight hall beyond.

Charter Freight Progress

IN the 1958 annual report issue of the *Air Market Review* from James Burness (Travel), Ltd., there are some interesting comments about freight progress.

"There was," the report states, "a general increase in inquiry for the movement of cargo and the number of fixtures concluded was very much higher than in previous years. This is an encouraging sign as the cargo business has shown a steady though slow growth throughout the year. The percentage of firm fixture to inquiry received, however, is well below that of the passenger business. The reason is, no doubt, that charter rates are not yet necessarily in line with the value of the cargoes which are proposed for shipment.

"Most of the freight consisted of machinery. At one time about 90% of the cargo carried by charter was ships' machinery, but industrial machinery and various kinds of commercial freight is now being handled in increasing quantities. Throughout the year there has been a steady demand for air space from Germany and Switzerland to North America for machinery and manufactured goods."

Weather Forecasts for the Jets

AN IMPROVEMENT in weather forecasting services is one of the urgent requirements for the successful operation of the turbojet transports. This is now generally recognized and has been stressed in recent lectures and discussions on turbojet operations and air traffic control problems. Mr. E. W. Pike, for instance, in his paper before the R.Ae.S. (see THE AEROPLANE for December 19, 1958) said that in the paper-flight operations of the Boeing 707 by B.O.A.C., there was on one occasion a difference of 45 minutes in the flight time based on two different forecasts. Capt. Hunt, who opened the discussion after this lecture, was of the opinion that standardized forecasts are an absolute "must" for the future.

Against this background, plans announced by the U.S. Weather Bureau for new forecasting services this year are especially interesting, as they do seem to go some considerable way towards providing the kind of service which is wanted—although only in a portion of the Northern Hemisphere. The new services will make better use of available information and are designed to meet the needs of the high-flying jet (20,000 ft. to 45,000 ft.), but the accuracy of the forecasts remains dependent on the information available to the forecaster—and in this connection considerable improvements can probably still be made.

Starting early this month, the National Meteorological Center in Washington, D.C., has been disseminating "prognostic wind flow charts" of a new kind over the facsimile chart circuit. These charts, for high-altitude turbojet operations, are prepared with the help of the Weather Bureau's electronic computer and cover more than half the Northern Hemisphere—from Japan and the Philippines to North America and Western Europe, and from the North Pole to the Equator. They are used as forecast guidance material at main meteorological offices in New York City, Miami, San Francisco, Anchorage (Alaska), Honolulu and San Juan (Puerto Rico), where the forecasters expand portions of the chart into three-dimensional operational forecasts, which in turn are transmitted over the facsimile network for use at other airports providing turbojet weather services.

Each of the major meteorological centres listed above will be responsible for its own area—thus, New York will forecast for the North Atlantic and Western Europe, Washington for North America, Miami for the Gulf of Mexico and West Caribbean, and so on.

As part of a continuing development plan, facsimile receiving facilities are being provided during 1959 at major turbojet airports, and transmitting facilities are being provided at the main offices in each area, where additional meteorologists, trained in high-altitude forecasting, will be located.

In Britain, meanwhile, the Meteorological Office has taken a further step in its research into "forecasting by numbers," by installing a high-speed Ferranti Mercury digital computer at Dunstable. Research into the possibilities of numerical weather forecasting has been going on since 1950 at the Meteorological Office, using computers in London and Manchester.

The new Ferranti computer, which will not be employed on the routine day-to-day preparation of weather forecasts until a further period of research has been completed, is suitable for use in the numerical forecast of pressure distribution at two levels in the atmosphere 36 hr. in advance. It will be possible to feed the computer directly with observations received by teleprinter, which it will interpret within approximately 30 minutes.

Methods of numerical weather forecasting developed in the United Kingdom, the United States, Sweden and other countries over the past 10 years seek to solve the atmospheric mathematical equations by numerical methods, and to predict the future state of the atmosphere from its present state. Most of these equations are known, but until recently they have proved too complicated to be of much value in forecasting. Even when the problem has been simplified as far as possible, it is still necessary to make more than five million arithmetical calculations if atmospheric changes are to be forecast for an area the size of North-West Europe and the British Isles over a 24-hr. period.

Various possible methods of numerical forecasting will now be investigated over a long series of weather situations, and the results compared with current forecasting techniques. The Mercury computer, which can do up to 3,000 multiplications per sec., will also be used for other meteorological research problems.

KARACHI-BOUND.—Handed over to Pakistan International Airlines earlier this month was the first of five Viscount 815s which the airline has on order.

C

Bristol Sales Engineering

British aircraft manufacturers in the past appear to have neglected some fundamental requirements in their efforts to sell commercial transports. These requirements are now more widely recognized. Here is how one company has set about meeting them.

TO be successful in selling transport aeroplanes to the World's airlines calls for salesmanship of a special kind. As we have said in these pages before, it is no longer sufficient to have a good aeroplane, nor even the right aeroplane. The manufacturer who seriously intends to stay in the civil aircraft business has no alternative but to set up a comprehensive specialist organization to form a bridge between design work (both project and detail) on the one hand, and airline requirements (both general and specific) on the other.

To cater for this need, Bristol Aircraft, Ltd., set up a Sales Engineering department some two years ago, and we recently had a chance to discuss the work and progress of this organization with its manager, Mr. Alec Symon. It is encouraging to find British aircraft manufacturers taking positive and successful steps to establish departments or groups of this kind, as it has been one of the major weaknesses of the industry in the past that no adequate means has existed of assessing market trends, feeding relevant information to the design teams, or even explaining the full potential of new aircraft to prospective customers; while liaison with actual customers both before and after delivery of their aircraft has at times been woefully inadequate.

Bristol's Sales Engineering department was born of experience, as any such organization must be. Although certain of the functions—and especially those of market research—can and should be carried on by a manufacturer with no airline customers, only the practical experience of producing aeroplanes to the particular requirements of various airlines (whose project engineers no doubt hold widely different beliefs—and prejudices) can show how best the liaison rôle can be fitted into the existing design and sales organization. In different companies, different solutions will be found.*

Before assuming control of Sales Engineering, Mr. Symon was assistant chief designer and design manager, and had frequently been called upon, in the course of the Britannia sales effort, to accompany sales representatives on overseas missions to help establish the engineering, performance and economic assessment of the aircraft with the customer. This was the background of experience, therefore, on which the department was built—and the appointment at its head of a former design executive ensured not only the technical integrity of the department, but also an efficient line of communication with the design and project offices.

The work of the department is divided into four sections, responsible for market research; performance and economics; engineering; and brochure production. As a whole, these four sections work primarily to provide a technical service—both routine and "on demand"—to the sales department, overseas agents, representatives and operators of Bristol products.

In reverse, as already explained, the department feeds back its knowledge, in the form of advice, recommendations and criticisms to the design office. So that experience with the Britannia is not lost, Sales Engineering now brings its expertize to bear, as a matter of routine, upon project designs at an early stage. To quote an example of this process in action, when the Bristol 205 short-haul turbojet was in the pre-design stages, Sales Engineering advised, from their knowledge of what would be acceptable to operators, the use of a lower pressure hydraulic system and better landing characteristics than had at first been suggested by the designers.

When a project such as the Bristol 205, or a new Britannia variant, reaches the point where it can be discussed with the operators, Sales Engineering becomes involved in producing the preliminary type specification and other technical sales literature (the writing of basic and customer type specifications is still a design-office responsibility). It follows that members of the Sales Engineering team will be well informed about any new project from the start, and will be busy assessing its performance by the yardsticks normally applied by airline operators—which have not always been in the past the yardsticks used to measure potential usefulness by designers and directors. As soon as the salesmen are ready to go "on the road" with the project, the sales engineers are available to go with them.

Not every project goes beyond this stage, of course; the Bristol 200 is an obvious example of a design upon which Sales Engineering spent many hundreds of man-hours but which may not be built. The effort, however, is not wasted, for every exercise of this kind helps to keep the company in touch with airline thinking and airline requirements and so influences the *next* aeroplane.

Market Research

A major rôle is played by the market research organization. This section has set out to keep a record of all relevant information about every major World airline—scheduled and non-scheduled, amounting to over 300 companies in all. The work of collecting, filing and indexing the source material is a mammoth one, though largely of a routine nature; sources include all published references, company timetables, agents' reports and other incidental "intelligence." From these reports, a weekly news bulletin is compiled for circulation within the sales department and to overseas agents, drawing attention to anything relevant to Bristol equipment and potential new outlets.

A large graphic wall-chart is maintained to show the present fleet situation of all these airlines—a chart on which each aeroplane—in use or on order—is shown by an individual pin, denoting aircraft type and make by its colour and size. Individual files on each airline provide basic reference material upon which to base economic studies and route analyses for a specific type of aircraft for service over any route network. Using a DEUCE computer, route analyses can quickly be prepared to show the performance of any particular type over specific routes in any selected conditions of wind, temperature, traffic potential and so on. Moreover, material in the file makes it possible to prepare a realistic assessment of operating costs for any particular airline, without necessarily waiting for the airline to make the initial approach or to provide relevant data.

A word of praise can be said here for the work of the brochure production section. For maximum effect, data must be clearly and concisely presented, and in this respect the reports produced by Sales Engineering—using the latest techniques of production and binding—are particularly good.

In addition to the routine tasks already outlined, the market research section undertakes more general surveys on the basis of its acquired knowledge. A complete economic study was made, for instance, on the market for an aeroplane of the Bristol 200 class in the mid-1960s, and another major task is the preparation of a five-volume study of the "Route Structures of the World's Great Airlines." This latter involves a detailed statistical analysis of every significant airline to show, in particular, the distribution of passengers carried by sector distance and aircraft type.

Work of this kind can have a considerable influence on company policy. It seems to be especially important at the moment that every opportunity should be given to units such as Bristol Sales Engineering to go steadily on with their work even when other departments may be passing through difficult times. Their contribution to the development of new civil aeroplanes can mean the difference between success and disaster.—F.G.S.

* See for instance, the article "Selling to the World's Airlines" in THE AEROPLANE for November 15, 1957, describing the organization at Vickers-Armstrongs (Aircraft), Ltd.

It's proof like this that sells me the VISCOUNT

Capital Airlines figures emphasise original economy claims of the Viscount 700

These figures are taken from a study of operating costs recently made by Capital Airlines. The original estimates made in May, 1954, are compared with actual costs experienced in service.

Cost per aircraft-hour flown	*Original Estimate*	*Actual 6-months period ended 30th June, 1958*
DIRECT EXPENSE		
Pilots' salaries, travel; engine fuels; hull insurance; etc.	$ 96.15	$ 95.85
Direct maintenance labour, materials	57.76	47.12
Aircraft depreciation	45.91	46.36
Total direct expenses	199.82	189.33
INDIRECT EXPENSES		
Assigned expenses (of all other elements of operating expense allocated to types of aircraft on a formula basis)	$169.52	$169.20
Total operating expense	369.35	358.53
Costs per revenue aircraft-mile flown		
DIRECT EXPENSE		
Pilot's etc.	$ 0.402	$ 0.383
Direct maintenance	0.242	0.188
Aircraft depreciation	0.192	0.185
Total direct expense	0.836	0.756
INDIRECT EXPENSE		
Assigned expense	$ 0.709	$ 0.697
Total operating expense	1.545	1.453

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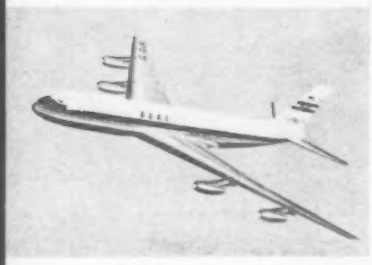
Practical Turbojet Operating Procedures



A GOOD DEAL has been said and written in recent months about the associated problems of economic turbine aircraft operations, and air traffic control, especially over the North Atlantic.* These problems are, naturally enough, very much in the minds of the various operators who are already, or soon will be, operating Britannias, Comets, Boeing 707s and other types over medium and long intercontinental sectors.

Some interesting facts and figures concerning jet operations in the view of the World's most experienced jet airline—B.O.A.C.—were given in the paper by Mr. H. E. Smith, Navigation Superintendent, read at the GATCO Convention last October. As we were not able to summarize this paper at the time, we are taking this opportunity of putting on record a précis, and some verbatim extracts describing Comet 4 and Boeing 707-436 operations in some detail.

Mr. Smith set out to underline the problems of air traffic control for jet aeroplanes and did so by examining the operating characteristics of this class of aeroplane as represented by the Comet and Boeing 707. In most important respects the problems will be common to any type of turbojet transport. There are two primary factors, said the author, affecting the efficiency of day-to-day operations. These are the operators' interpretations of performance, or cruise control as it is usually known; and the degree of freedom available in the airspace to use this interpretation of performance efficiently. The former will be little use unless matched by the latter.

Since the operating costs of the jet are so high, especially as a result of high fuel consumption, the operator must be particularly weight- and time-conscious throughout the operation. Every item of deadload carried to destination (including terminal and diversion fuel reserves as well as payload) requires, to carry it on stage distances such as London-New York, about 50% of its own weight in fuel to be burned en route.

The basic requirements for successful operations are now well understood, including the technique of cruise control. As fuel is burned, a large, continuous weight reduction takes place and altitude can be progressively increased unless limited by design characteristics. The maximum operating altitude of the Comet 4 is 45,000 ft., with safety margins, but the author did not expect 41,000 ft. would be exceeded on the North Atlantic. The maximum operating altitude of the Boeing 707 and Douglas DC-8 is 40,000 ft.

In preparing initial cruise control studies, care needs to be exercised over manufacturers' performance data with the usual tolerances on guarantees, and allowance must be made for deterioration of engines and airframe. One per cent. here or there on a piston-engined aircraft does not amount to much, but the Boeing 707-420 will consume about 100,000 lb. of fuel on a typical North Atlantic crossing; 1% of this is 1,000 lb., which would make serious inroads into the profitable payload.

Optimum range is achieved theoretically at 1.19 VMD (minimum drag speed) at max. cruise r.p.m. This, therefore, requires the aircraft to climb throughout the flight; but other factors affect the final choice of speed ratio and r.p.m.

For example, if the Boeing 707 was cruised at maximum r.p.m. and altitude the drag rise caused by compressibility would be around 11% of the total drag, but by restricting r.p.m. at a lower altitude and using lower lift coefficient, the drag rise can be reduced to an optimum range figure of only 3%. Economy, therefore, is not necessarily gained by flying as high as possible in this type of aircraft.

Examination of the proposed Comet 4 and Boeing 707 operations left B.O.A.C. in no doubt that the primary procedure must be a cruise/climb or "drift up." The portion of Mr. Smith's paper describing Comet and 707 operations follows in full:—

Comet 4

In the Comet 4 operation the cruise/climb procedure has been designed to combine high specific range with a reasonably high speed. It is achieved by operating at a constant .73 Mach (indicated) and a constant 1.15 VMD. This procedure is maintained by flying the airspeed appropriate to weight and adjusting the r.p.m. to obtain the appropriate altitude.

In practice, as the top of initial climb is reached, the climb r.p.m. of 7,350 is maintained until the correct airspeed for the cruise is reached. The engines are then throttled to the appropriate values and finally adjusted to maintain the required airspeed and altitude. During this cruise the average rate of climb is about 20 ft./min., and the mean T.A.S. approximately 400 kt.

In the initial climb after take-off, the rate of climb of the Comet 4 varies with weight and temperature. Some average values are: up to 6,000 ft., 1,300 ft./min.; at 10,000 ft., 1,600 ft./min.; at 20,000 ft., 1,200 ft./min.; at 30,000 ft., 600 ft./min.

Variations from these averages may be as much as 500 ft./min. at weight and temperature extremes. Thus in standard conditions at a weight of 137,000 lb. the rate of climb at 10,000 ft. is approximately 2,100 ft./min., but, at 20° C. above standard after a maximum weight take-off, the rate of climb at 30,000 ft. may be as low as 150 ft./min. On a normal take-off the Comet 4 should average about 500 ft. in the first mile.

The time to cruising altitude also varies with weight and temperature. At a maximum take-off weight of 158,000 lb. in standard conditions the top of the initial climb, where cruise/climb could be commenced, is 33,000 ft., the mean T.A.S. is 343 kt. and the time on the climb is 29 minutes. The T.A.S. increases from about 160 kt. at 1,000 ft. to 290 kt. at 6,000 ft. and thereafter continues to increase by about 10 kt. per 2,000 ft. up to about 30,000 ft.

B.O.A.C. has prepared two additional procedures which may at times be operationally desirable and more often will be an A.T.C. necessity. These are operated in level flight at .75 Mach (ind.) and .69 Mach (ind.), respectively.

The first is a maximum-speed cruise which might possibly be used when the wind component is favourable on a sector such as Gander/New York. The second case, excluding the cruise/climb, is a maximum economy cruise. In both cases the best range is fundamentally available at the maximum altitude. As height is reduced, T.A.S. increases, but in the case of the maximum speed cruise at .75 Mach when cruising below 32,000 ft., the aircraft is limited by VNO, which is 270 kt. I.A.S.

The normal descent is made at 220 kt. I.A.S and gives a rate of descent of about 800 ft./min. above 30,000 ft. and 1,200 ft./min. below 30,000 ft. By extending the dive brakes and using flaps, this can be increased to 3,000 ft./min. and if the speed is increased to 260 kt. I.A.S., 4,500 ft./min. can be achieved. However, passenger comfort is an important factor which must be considered before such fast rates are used. In normal descent, the true airspeed decreases from about 400 kt. at 40,000 ft. to 200 kt. at sea level.

In holding patterns the aircraft is held at 210 kt. I.A.S. and at high altitude, where any lengthy delay must be taken up, Rate ¼ turns are executed.

In the event of a loss of power from an engine, appropriate three-engine r.p.m. are set up and the aircraft drifts down to the three-engined altitude and air speed. The r.p.m. is held constant at 7,350 and the air speed appropriate to 1.2 VMD is employed, giving a cruise/climb procedure. The loss of altitude from the four- to three-engined flight path is clearly dependent initially on the four-engined cruise procedure being followed, but, assuming it to be the primary cruise/climb, loss of altitude is of the order of 2,000 ft.

There is one further procedure which, although circumstances in which it would be used are unusual, is of particular interest as it indicates another example of the required freedom in the vertical plane. In the unlikely condition of severe turbulence the Comet's cruise air speed would need to be reduced by about 12-14 kt. and Mach number reduced to .66 (ind.). To achieve this without the I.A.S. falling below the recommended value, it is necessary to reduce r.p.m. by about 300 and descend 2,000 ft. If a descent was not carried out and the aircraft was simply throttled and Mach number reduced, the I.A.S. would fall by as much as 20 to 25 kt. and the buffet (aerodynamic instability) boundary region would be entered.

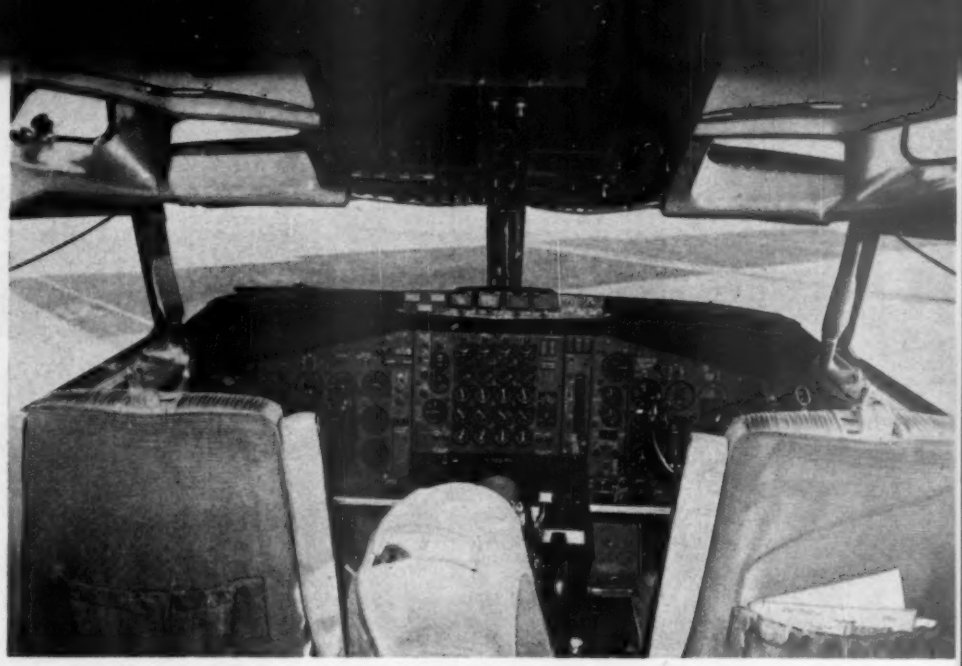
Boeing 707-436

The theoretical optimum range criteria and the effect of compressibility drag rise in the main dictate the choice of primary Boeing procedure. This is a cruise/climb which is operated at a constant Mach number of .78 and a constant speed ratio of 1.10 VMD, the engine r.p.m. being set to give about 80% of maximum cruise thrust. In a North Atlantic crossing the cruising altitude will increase from the initial figure of about 33,000 ft. to a maximum of 40,000 ft. The correct pressure altitude depends only on instantaneous weight.

Ample engine power below the maximum cruise condition is

D

* See, for instance, summaries of three papers on air traffic control at the GATCO convention, THE AEROPLANE, October 31, 1958; a paper by Mr. J. E. D. Williams on Britannia operations, THE AEROPLANE, December 12 and December 26, 1958; a paper by Mr. E. W. Pike on "A.T.C. Over the North Atlantic," THE AEROPLANE, December 19, 1958; and a paper by Mr. E. Chambers on jet streams, THE AEROPLANE, January 2, 1959.



The pictures on this page are interesting as showing the environments in which the operational techniques described in the accompanying article are applied. On the right is the flight deck of a Pan American Boeing 707-121. That of B.O.A.C.'s 707-436 will be generally similar, though some of the instrumental and other equipment will be of different types.

Photograph copyright "The Aeroplane"

available to maintain the required altitudes; temperature does not affect cruise specific range and, as a constant Mach number is maintained, cruising speed increases with temperature increase.

During the cruise/climb, the rate of climb is approximately 20 ft./min. and mean T.A.S. is 450 kt.

At the present time, as there is no Mach lock available, the best practicable approximation is achieved by flying constant I.A.S. related to a weight bracket. As constant I.A.S. is maintained within each weight bracket the aircraft will climb as fuel is consumed, but less than it would if a true constant Mach number was practicable. This is, however, taken care of on every occasion that the weight bracket changes by reducing I.A.S. to give altitude increases of about 400 ft. The duration of each weight step is between 40-70 min., dependent upon weight and temperature. During the step, Mach number increases slightly. For level-flight conditions, a Mach number of .78 still produces the most economical cruise conditions.

This procedure would be flown with altitude lock engaged and using an I.A.S. associated with the weight bracket. As top of initial climb is reached the aircraft is permitted to accelerate to the required I.A.S. for the altitude and the r.p.m. then throttled back to that appropriate to ambient temperature, altitude and weight.

If the primary cruise/climb procedure cannot be used then a variation of the level procedure with suitable altitude steps would be chosen—in other words, a step-cruise. In climbing from one level to another an I.A.S. of 245 kt. would be operated.

In the climb after take-off to initial cruise height, maximum continuous engine rating of 9,710 r.p.m. is used. A constant I.A.S. is maintained at 275 kt. up to 20,000 ft. where it is reduced to 260 kt. The mean rate of climb to 33,000 ft. at max. take-off weight is approximately 1,200 ft./min.

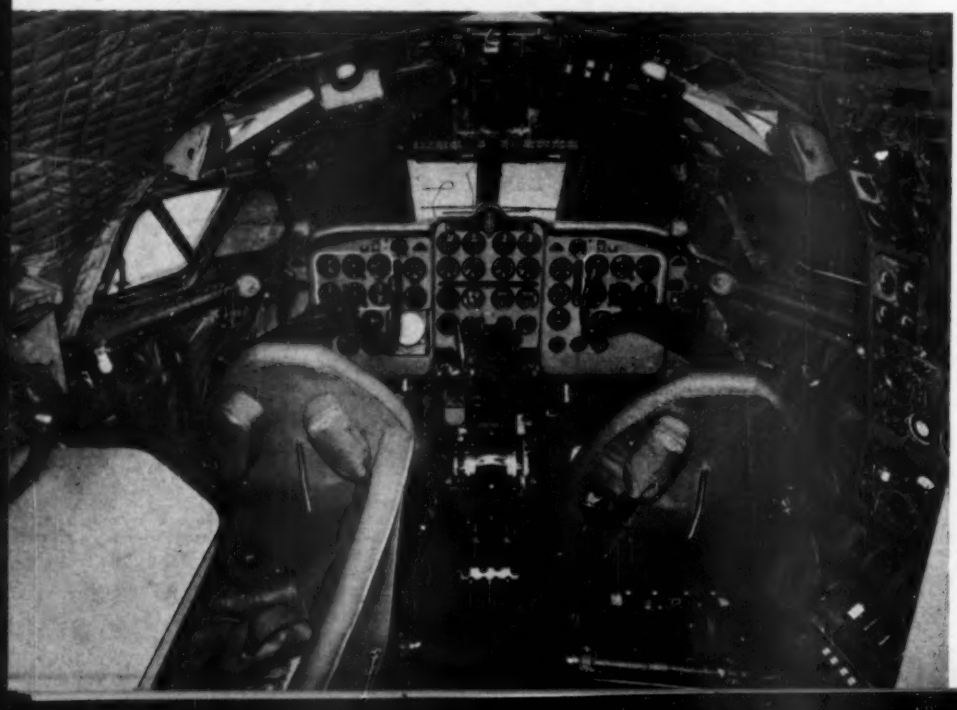
Two procedures have been prepared for the descent. First, an optimum range and, secondly, a high-speed procedure. The optimum range is achieved at an I.A.S. of 265 kt. or Mach .78 above 35,000 ft., the mean rate of descent being approximately 1,500 ft./min. The high-speed procedure is carried out at 340 kt. I.A.S. with engines throttled to give 1,400 ft./min. rate of descent above 28,000 ft. and 2,000 ft./min. below 28 000 ft. Descent time is reduced by 4 min.; fuel burn off is, of course, increased.

Holding procedure for the Boeing will be at an I.A.S. of 225 kt. with the aircraft in clean configuration and, as in the case of the Comet, at high levels Rate ½ turns will be made.

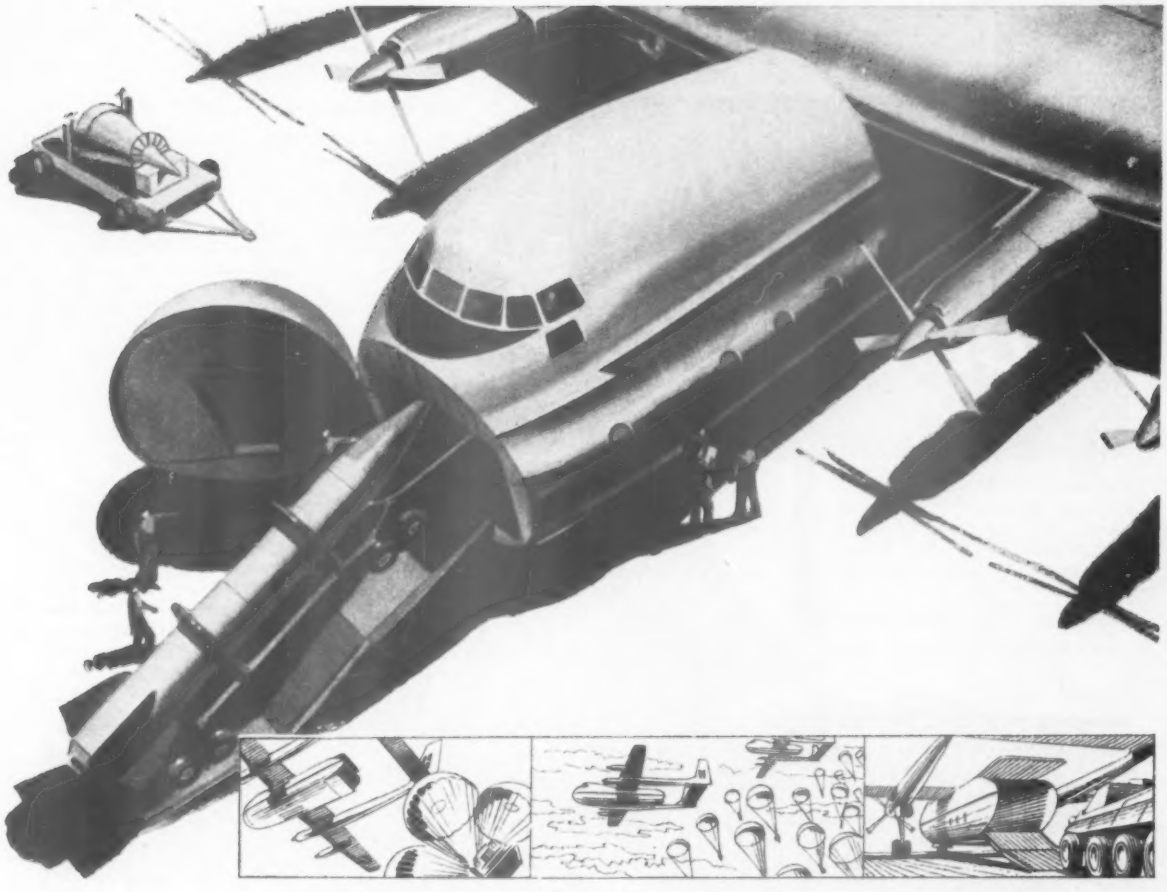
With the loss of an engine, very little loss of speed is experienced as the three remaining engines would be cruised at full cruise r.p.m. There is a loss of range of about 5%. Assuming that a four-engined cruise/climb was in progress in standard conditions there would be a loss of altitude of around 2,000 ft. However, if a flight level above optimum altitude was being flown then the loss of altitude would be more than 2 000 ft. But if a flight level below optimum was being flown the loss in altitude would be insignificant.

Mr. Smith then went on to plead for freedom in air space—an argument developed more fully by Mr. E. W. Pike in his more recent R.Ae.S. paper "A.T.C. over the North Atlantic." The effect of departures from the optimum flight path was stressed by Mr. Smith. For instance, if the cruise/climb is prohibited and quadrantal separation standards are applied, the penalty in the Boeing 707 for increasing height in 2,000-ft. steps would be about 750 lb. in payload, and, in 4,000-ft. steps, about 1,300 lb. in payload. Reduction in range is about 0.5% for plus or minus 1,000 ft. deviation from optimum altitude, but the percentage loss increases very rapidly—to 5% for plus 4,000 ft. and 2% for minus 4,000 ft. at the highest altitudes.

In practice, according to Mr. Smith, cruise/climb procedures are limited by circumstances, communications and other traffic and even when possible are not of optimum profile. B.O.A.C. experience at lower and high levels during the summer of 1958 led to the conclusion, moreover, that flight plans filed for stepped-cruise are no more likely to be unrestricted than cruise/climb plans.



The Comet 4 control cabin with a portion of the flight engineer's instrument and control panel to be seen on the right. The navigator's station is on the left. On the North Atlantic Comets the Decca/Dectra Flight Log will, in due course, as illustrated in last week's issue (page 36), be positioned in the upper part of the central engine instrument panel.



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The Fighting Services

Air Officer Appointments

AIR CHIEF MARSHAL SIR THEODORE N. McEVOY, K.C.B., C.B.E., is to become Air Secretary at the Air Ministry on May 1. Chief of Staff, Allied Air Forces Central Europe, since May, 1956, he was previously R.A.F. Instructor at the Imperial Defence College. Between 1950 and 1953 Air Chief Marshal McEvoy was Assistant Chief of the Air Staff (Training) at the Air Ministry.

The present holder of the post of Air Secretary since February, 1957, Air Marshal Sir Denis F. H. Barnett, K.C.B., C.B.E., D.F.C., has been appointed A.O.C.-in-C., Transport Command, with effect from May 4, in succession to Air Marshal Sir Andrew McKee, K.C.B., C.B.E., D.S.O., D.F.C., A.F.C., who will be retiring from the Service. Appointed A.O.C., No. 205 Group, M.E.A.F., in 1954, Air Marshal Barnett was Air Task Force Commander during the Suez Canal operations. Before going to the Air Ministry he was Commandant of the R.A.F. Staff College, Bracknell.

Air Marshal W. H. Merton, K.C.B., O.B.E., is to succeed Air Chief Marshal McEvoy as Chief of Staff, Allied Air Forces Central Europe, on February 2. Air Officer-in-Charge of Administration, Bomber Command, since September, 1956, Air Marshal Merton was previously Chief of the Air Staff, R.N.Z.A.F. His appointment at Bomber Command has been taken over by Air Vice-Marshal B. K. Burnett, D.F.C., A.F.C., who was Director of Operations (Bombing and Reconnaissance) at the Air Ministry between 1956 and 1957.

Gp. Capt. D. C. McKinley, C.B.E., D.F.C., A.F.C., has become Director of Operational Requirements (C) at the Air Ministry, with the acting rank of Air Cdre. Completing the 1958 course at the Imperial Defence College, he previously commanded the R.A.F. unit at R.A.E. Farnborough.

The R.C.A.F. in 1958

DURING the past year a number of developments have taken place in the R.C.A.F., including the introduction of two new aircraft types into squadron service, and future changes in the Service have been outlined by the Canadian Government.

In September the Canadian Prime Minister, Mr. Diefenbaker, announced that an integrated weapons system which includes Bomarc SAMs and SAGE (Semi-automatic Ground Environment) would be introduced into the Canadian air-defence organization by 1961. The joint Canadian/U.S. Pinetree radar line would also be extended and strengthened. Two bases for firing Bomarcs are to be constructed in the general northern Ontario and Quebec areas and others may be located in Canada in the later development of the new programme.

Other events affecting the future of the R.C.A.F. Air Defence Command were the first flight of the Avro Arrow in March, and the statement by Mr. Diefenbaker in September announcing that the development programme for the all-weather fighter and its Iroquois powerplants would continue until March of this year, when the situation will be reviewed again in the light of existing circumstances. A flying-safety development in the Command during last year was the installation of runway barriers at seven airfields.

The first Canadair CL-28 Argus was officially handed over to the Maritime Air Command in May, 1958, and later in the year one of the anti-submarine aircraft was flown to the NATO Headquarters of the Supreme Allied Commander Atlantic at Norfolk, Virginia, where it was demonstrated to senior officers. Also during 1958, Neptunes started replacing the Lancasters of the Command's No. 407 Squadron at Comox, B.C.; when the replacement programme is completed Argus and Neptune aircraft will be operated from bases on the east coast of Canada and Neptunes will be based on the west coast. At the two Canadian east-coast stations previously selected as major centres for maritime operations—Summerside and Greenwood—work was started on two $7 million programmes to provide additional operational facilities.

Nearly 14,000,000 lb. of freight and 70,000 passengers were carried by the R.C.A.F. Air Transport Command, which included more than 180 scheduled round flights to Europe in support of the No. 1 Air Division and the United Nations Emergency Force in the Middle East.

In July the original NATO aircrew training scheme which started in 1950 was officially closed at R.C.A.F. Winnipeg, and the final intakes are now nearing the completion of their courses. Under separate agreements replacing the original plan, training is continuing for a limited number of aircrew from Norway, Denmark, the Netherlands and Germany. In addition, an R.C.A.F. advisory group from the No. 1 Air Division organized the start of operational training of German pilots on Canadair Sabre 6s at Oldenburg, Germany.

Point to Point

IN recent months Avro Vulcans of Bomber Command have established a number of point-to-point records. These include Waddington-Naples (1,121 miles) at 615 m.p.h.; Nairobi-Salisbury (1,066 miles) at 608 m.p.h.; Boston-Waddington (3,310 miles) at 621 m.p.h.; Ottawa-London (3,345 miles) at 627 m.p.h.; El Adem-Embakasi (2,530 miles) at 637 m.p.h. and the first coast-to-coast (Labrador-Northern Ireland) Atlantic crossing (1,943 miles) in less than 3 hr.—an average of 649 m.p.h.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Wing Commanders: J. A. Bush, D.F.C., to R.A.F. Lindholme as officer commanding the flying wing and training; C. C. Calder, D.S.O., D.F.C., to R.A.F. Waddington for instructor duties; K. C. Giddings, O.B.E., D.F.C., A.F.C., to R.A.F. Honington to command No. 57 Sqn.; H. B. Hunt, D.S.O., D.F.C., A.F.C., to Headquarters, Bomber Command, to command the Operations Centre; K. F. W. Tapper, M.B.E., to the R.A.F. Staff College, Andover, for directing staff duties.

Squadron Leaders: E. R. Bangor-Jones to Headquarters, Coastal Command, for air staff duties (with acting rank of Wg. Cdr.); D. G. Bladon to Headquarters, Transport Command, for air plans duties (with acting rank of Wg. Cdr.); H. G. Currell, D.F.C., A.F.C., to R.A.F. Benson as officer commanding The Queen's Flight (with acting rank of Wg. Cdr.); W. K. Greer, A.F.C., to No. 4 School of Recruit Training, Wilmslow, to command the Training Wing (with acting rank of Wg. Cdr.); E. H. Jenkins to Headquarters, Maintenance Command, for administrative staff duties (with acting rank of Wg. Cdr.); W. S. Northcott, D.F.C., to the Joint Anti-Submarine School, Londonderry, for administrative duties (with acting rank of Wg. Cdr.); W. J. P. Straker, A.F.C., to Air Ministry for duty in the Department of the C.A.S. (with acting rank of Wg. Cdr.); D. R. Wilson to R.A.F. Brockzetel, 2nd T.A.F., for technical duties (with acting rank of Wg. Cdr.).

F.E.A.F. VISITOR.—The C.-in-C. of the Vietnam Air Force, Col. N. X. Vinh, recently visited R.A.F. Tengah, Singapore. He is seen here with the commanding officer of No. 60 Squadron, Sqn. Ldr. M. C. N. Smart, A.F.C., inspecting one of the unit's D. H. Venom FB.4s.

Progress Report on the Magister

by John Fricker

IN recent years the Potez Air-Fouga Magister has gained an impressive international reputation as a widely used basic jet trainer, having been flown or ordered by the air forces of France, Germany, Belgium, the Netherlands, Finland, Israel and Austria. Its progress is particularly interesting in having been achieved despite the use of twin engines, with corresponding maintenance complication; its unconventional configuration, including a "butterfly" tail; and a tandem seating layout.

The last-mentioned is against current R.A.F. policy, but appears to be in favour with NATO. Its most undeniable advantage seems to be the retention of the same view and environment, whether dual or solo, by the pupil in the front seat throughout his training as he will find in operational aircraft. But this only applies to fighter pilots, who are alleged to be a dying breed, so perhaps the R.A.F. views on side-by-side trainers are more applicable after all.

Whatever the merits of its layout, the Magister is being sold in considerable numbers, which argues favourably on behalf of its flying characteristics and training record. It has been in service with the French Air Force School at Salon-de-Provençe since May, 1956, at first for basic training, after initial instruction on the Morane-Saulnier M.S.733.

By last month about 60,000 hr. flying had been completed by French Air Force Magisters, and additional experience had been gained by the German Luftwaffe. Forty French-built Magisters were delivered to Germany by April, 1958, after which Heinkel and Messerschmitt continued deliveries from licensed production to fulfil the total order for 250 aircraft. As in France, the German Magisters are replacing veteran Harvard trainers, after which pupils continue on to the Lockheed T-33 for advanced jet training.

Forty-five Magisters were ordered on September 23, 1958, by the Belgian Government to replace Harvards at Kamina, in the Congo, where advanced training will be given to Belgian and Dutch military pilots. In the case of the Israeli Air Force, a licence for Magister construction was acquired in September, 1957, by Badek Aircraft, Ltd., at Lydda, and a few French-built C.M. 170s are also being supplied.

Through the courtesy of M. Mauboussin (the second initial in "C.M."), and the chief test pilot of the French Centre d'Essais en Vol, Cdte. Fleury, I was able, a month or two ago, to make a fairly extensive handling flight in a Magister at Bretigny, just south of Paris. This was an opportunity I had long awaited, but it is not my intention to present a very detailed handling report on the Magister; a comprehensive flight assessment of the prototypes by James Hay Stevens appeared in THE AEROPLANE of July 2, 1954. I would, however, like to give some fairly general impressions, based on handling other jet trainers, such as the Hunting Jet Provost, the Miles Student, Lockheed T-33, etc.

Although nominally a basic trainer, the Magister has a performance not far short of the Vampire 5; it is pressurized, and is equipped for full bombing, gunnery or missile armament training. Like the Vampire, it sits very close to the ground on a short undercarriage, and the relationship is furthered by the use, in the prototypes, of standard Vampire seats. This gives some indication of the amount of room in the cockpits, which are well laid out, in French Service pattern with conveniently placed controls.

For my familiarization flight, which was with Capitaine Cannac, a C.E.V. test pilot, I sat in the rear, or instructor's, seat. Because of the heavy frames of the two upward-hingeing hatches, the view from the rear seat is not so good as in other tandem trainers with "tube" canopies, such as the T-33 or North American F-100F. To rectify this, an S.F.O.M. periscope is provided and, with practice, this gives surprisingly good results. It is linked with a gunsight for armament training.

I was slightly surprised to find that the instructor's cockpit has no cabin altimeter, Mach meter, or (most important) fuel gauges, but the last two instruments are right at the top of the front panel, where they can be seen by craning over the student's shoulder. The instructor also has a fuel warning light, which indicates the 200-litre (44-gal.) level, and override controls for flaps, air brakes, elevator trim and VHF.

Trimming is provided only for the longitudinal controls, via a slightly clumsy thumb switch on the moulded and high-pivoted stick, and in the aircraft flown there was a lateral out-of-trim force to the left.

The large plate-type rudder pedals, incorporating toe brakes, are adjustable for reach via a small crank on the starboard cockpit wall. A more unusual item for personal comfort is an additional harness strap, which extends between the legs from under the seat and plugs in to the bottom of the quick-release box. It is very effective in keeping one firmly in one's seat under negative *g* conditions and could be usefully added to our own military harnesses.

The throttle levers of the two inboard-mounted 880-lb. Turboméca Marboré II turbojets can be actuated as one for most flight manœuvres, and as there is no asymmetric thrust effect, *ab initio* students are not confused by the power duplication. This is, nevertheless, a useful safety feature, since the Magister has an excellent single-engined performance, and it also allows emergency procedures, such as relights, to be practised at an early stage of training.

Starting is simple by means of a non-automatic sequence, and only on the ground is it necessary to handle the throttles with reasonable care to avoid compressor stalling. At any speed above 100 knots, and at any height, engine acceleration is governed regardless of the speed of throttle movement. Ground idle is about 6,400 r.p.m., and after opening up to begin moving, 10,000 r.p.m. or thereabouts is sufficient for taxi-ing. With its low C.G. position and very wide undercarriage track, the Magister is extremely stable on the ground, and steers easily on its castoring nose-wheel with a jab or two of its hydraulic brakes.

Pre-flight checks include canopy lock-warning light "off"; cockpit seal and pressurization "on"; and selection of 15° of flap. The hydraulically operated Fowler-type flaps are selected by a small switch on the port console, and there is a position indicator on the front panel. Flap settings are infinitely variable, but only two positions are marked for extension, to 15° and 40°.

After checking full power of 22,600 r.p.m. and 650° C. maximum J.P.T. when lined up, releasing the brakes results in

a pleasant acceleration. The Magister was easy to keep straight despite a 90° port cross-wind, and rudder control became effective almost immediately. Gentle back pressure to avoid touching the runway with the tiny tailwheel raises the nose at about 60 knots, and after a brief further run the aircraft unsticks at about 90-95 knots. It was not necessary to use the periscope during take-off, the view through the side windows being adequate.

Like other centrifugal engines, the Marborés do not like water in the intakes, so to avoid a flame-out when taking-off from a thoroughly wet runway, Magister pilots are advised to raise the nose as soon as possible. After undercarriage and flap retraction (below 140 knots), both with little change of trim or sink, speed can be allowed to build quickly up to 200 knots, and the initial climb entered at just under 3,000 ft./min.

We were flying with full tip tanks and internal fuel, giving a total tankage of about 215 Imp. gal. In climbs to height (service ceiling of the Magister is about 35,000 ft.), 200 knots is maintained at 21,750 r.p.m. until M=0.42 is reached, and this then becomes the climbing speed.

In cruising flight, at about 21,000 r.p.m. and 240 knots I.A.S., Magister handling revealed no indication of the slightly unconventional empennage, and this applied to the rest of the flight. The directional and longitudinal control from the vee-tail surfaces were both light and sensitive, but I was slightly disappointed in the ailerons, which were heavier than one expects from a Continental aircraft, although quite crisp.

It was afterwards explained to me that the first production batch of Magisters (of which the one flown was the 35th) had narrow-chord ailerons, but are considered quite suitable for basic training at the French schools. Later variants, including those used by the Germans, have wide-chord ailerons, giving improved lateral control, but for operational and armament training the school at Meknès requested power-boosted ailerons with artificial feel. These are being incorporated in current production aircraft.

With the narrow ailerons, the stick-forces increase noticeably at higher speeds, but there are no adverse control effects up to the compressibility limits of the Magister. Aileron buffet begins to become fairly pronounced at M=0.8, but to reach the authorized limit of M=0.82 it is necessary to make a full-power 40° dive from about 30,000 ft. A slight reversal of longitudinal control may become apparent around the limiting speed, but recovery quickly follows reduction of power, extension of the air brakes or normal pull-out action.

Before exploring the aerobatic capabilities of the Magister, it was necessary to jettison the little remaining fuel in the tip tanks, which streamed brief plumes of vapour. Rolls were easily accomplished at any speed between 200-300 knots, at the cruising power setting, and a loop requires an entry speed of about 280 knots.

I proved the docility of the Magister in no uncertain fashion with my first loop. After an initially heavy pull, the longitudinal control force lightened rapidly as the Magister went over on its back. Instead of then leaving the stick fairly central as the speed fell to about 100 knots, I gently pulled it back, as one might in a Tiger Moth.

The inverted Magister shuddered briefly, one wing snapped down, and we found ourselves pointing vertically upwards, with not even the maker's name on the clock, in a rather unnerving silence. Feeling slightly surprised, I wondered vaguely what to do. Capitaine Cannac, with both patience and courage (it was his second trip in a Magister), refrained from interfering, but when I eventually pushed the stick forward we flopped over into an immediate recovery.

After apologies my next efforts were slightly more successful, and I spent a happy few minutes (which the gallant Capitaine bore stoically) in throwing the responsive Magister about the sky. Stalls then proved quite straightforward in all configurations, at 80-90 knots I.A.S., and I tried a spin in each direction to see how the vee tail coped with that.

Entry was conventional, with a fair amount of "elevator" buffet at the stall, some lateral unsteadiness and a smart roll as "rudder" was applied. In both spins I found difficulty in getting them to develop, even after a wing drop into a fairly slow spiral, and I suspect that I should have held the Magister in for several more turns to have achieved a true autorotation. As it was, normal recovery action immediately converted the spin into a fairly steep dive, and the Magister was back to straight-and-level flight in a further 1,500 ft. I believe the developed spin is somewhat rougher, with 1,000 ft. lost per turn, but recovery is quite conventional.

From our finishing height of about 15,000 ft., extension of the wing air-brakes resulted in a descent of some 4,000 ft./min. at 250 knots, with the usual mild buffet. The variable-position air brakes did not seem particularly powerful below about 250 knots, and to reduce speed in the circuit it was necessary to throttle back to flight idling (15-17,000 r.p.m.). Deceleration to the undercarriage limit speed of 140 knots was still fairly slow, but air-brake extension caused little change of trim.

The same was true of the undercarriage, which unlocked with a bang and caused a very slight nose-down tendency. Even after adding partial flap and keeping the air brakes out, I found no necessity to add power during the base leg, where the speed was allowed to fall to 110 knots, nor on the final approach with full 40° of flap at 100 knots. The approach attitude of the Magister is fairly flat, and after reducing speed over the hedge to 90 knots, little further aft stick movement is required for a nose-high landing.

This was just as well, since my first touch-down was a matter of feeling for the ground while peering, rather unsuccessfully, through the periscope. This is similar to binoculars in that unless one looks squarely through the optical axis, the result is a black-out. My mistake was to try to lean forward against a tight harness, to look *in* the periscope instead of *at* it. In the latter case the result is an apparently uninterrupted view of the ground immediately ahead.

There is in any case a sufficiently good sideways view for height assessment when landing, and my touch-down was gentle enough. The Magister then conformed to most nose-wheel jet standards in requiring determined braking during the landing run, which is a good thing in a trainer.

In a subsequent circuit I tried flying on asymmetric power, with little effect except for a slow reduction in speed. I did not try an overshoot on one Marboré, but this is apparently quite practicable, with an initial climb of 500 ft./min. at 120 knots, increasing to 1,000 ft./min. at 140 knots after flap retraction.

Flying the Magister was an enjoyable experience, and did much to explain its success. Viceless, and yet reasonably representative of more operational types, it appears capable of being used through both basic and advanced stages of military flying training, although power-boosted ailerons are desirable for the latter part.

Leading Particulars

DIMENSIONS.—Span (inc. tip tanks), 39 ft. 10 in.; length, 33 ft.; height, 9 ft. 2 in.; wing area, 186.1 sq. ft.

WEIGHTS.—Tare, 4,268 lb.; equipped, 4,673 lb.; gross weight as basic trainer (inc. tip fuel), 6,807 lb.; max. gross, 6,978 lb.

PERFORMANCE (tip tanks full).—Max. speed, sea level 350 knots, at 30,000 ft. 385 knots; initial climb, 2,905 ft./min.; service ceiling, 35,000 ft.; take-off run, 2,030 ft.; to 50 ft., 3,050 ft.; range at 30,000 ft. (with 26.6-Imp. gal. reserve), 640 n.m.; endurance, 30,000 ft., same reserve, 2 hr. 40 min.

Lockheed JetStar

—In Production with Bristol Engines

PRODUCTION deliveries of the Lockheed JetStar are offered in August, 1960, as a result of a company decision to put the aircraft into immediate production without waiting for orders. These initial models will be powered by two Bristol Orpheus engines each (supplied by Bristol-Siddeley Engines, Ltd., from the U.K.); a year later, in August, 1961, the JetStar will be available with four Pratt & Whitney JT12 or General Electric J85 engines for customers preferring this layout.

Lockheed's decision to go ahead with production of the JetStar at its Marietta, Georgia, factory is a gamble of, perhaps, even larger proportions than that by Boeing with the original 707—although, like the 707, the JetStar seems to have a well-assured future. Expenditure on the two prototype JetStars—built at Burbank, California—is reported to have been $11 million, and another $20 million will be required to establish production. Selling price of the basic aeroplane will be $800,000, or $1 million when equipped; at this price the break-even quantity seems likely to be between 150 and 200 units.

Against this, Lockheed have provisional orders for more than 70 JetStars from executive and business customers, some of whom have paid cash deposits to reserve production-line positions. These orders alone would not have been sufficient reason to put the JetStar into production, but Lockheed estimate their chances of getting a military order to be good—and better for having a production article to offer.

The JetStar was designed, from the outset, to meet a military requirement communicated to the industry on August 9, 1956, for a medium-weight, multi-engined jet utility transport/trainer to carry 8-10 passengers for 1,500 naut. miles. The industry was invited to build prototypes of this (the UCX)—and of a small jet utility trainer (the UTX)—with its own funds for U.S.A.F. evaluation with a view to production contracts being placed. After various projects had fallen by the wayside the field was narrowed down to one aeroplane—the North American Sabreliner—in the smaller category (see THE AEROPLANE, November 28, 1958) and two—JetStar and McDonnell 119—in the larger class. McDonnell have not yet flown a prototype of their model 119 (see THE AEROPLANE, July 4, 1958); this fact, and shortage of funds, accounts for the U.S.A.F.'s delay in placing an order for the UCX.

Lockheed wasted no time in deciding to enter the competition in the UCX category by building two prototypes in its Special Projects Department. Using a technique previously applied to other Lockheed prototypes, the CL-329, as the project was originally known, was handed to a small, select group of engineers under the direct control of Mr. Clarence L. (Kelly) Johnson, vice-president for advanced development projects. Operating "in a vacuum" at the Burbank factory, this group concentrated its efforts wholly on the CL-329, which was brought to first flight in 241 days from the beginning of design.

Although the JetStar is the first Lockheed turbojet transport flown, the company has expended some $7 million since 1944 on engineering studies—including mock-ups and wind-tunnel investigations—of larger jet transports. The design of the JetStar was based upon one of the final projects in this series of studies, the Lockheed L-193, which had been studied in great detail in 1953. This early design work by Lockheed on jet transports, which led the company to favour rear engine mountings, has been described by Mr. Johnson in a paper before the I.Ae.S., extracts from which are on pp. 74-75.

The CL-329 was undertaken, then, as a small-scale version of the L-193. Some rapid preliminary design studies were first made, however, to see if the jet flap principle could be incorporated to improve the take-off and landing characteristics. While there was apparently an improvement in maximum lift to be obtained in this way, several major problems outweighed this advantage, and after some wind-tunnel tests the jet flap configuration was rapidly abandoned. The drawbacks included the need to predict take-offs and landings on the basis of half the powerplants being out of action; the complication of ducting to route the exhaust from each engine to both wings (to avoid high rolling moments with one engine out); loss of take-off thrust; and longitudinal control problems.

In its original letter the U.S.A.F. specified that the UCX should be able to carry 10 passengers and a crew of two over a 1,500-naut.-mile range (with military reserves) cruising at 435 knots at 45,000 ft. At overload weight and with external tanks a range of 2,200 naut. miles was required against a 70-knot headwind with 30-minute reserve—which was equal to a still-air, no-reserve range of 2,800 naut. miles. This range requirement was one of the hardest to fulfil.

Choice of Engines

The requirement also specified four engines, and this, too, proved to be a major stumbling block to rapid development of the aircraft since the only suitable American engines—the General Electric J85 and Fairchild J83—could not be available until some 12 months after Lockheed hoped to have the airframe ready. (The Fairchild J83 has since been abandoned and use of the J85 has delayed flight testing of both the Sabreliner and the McDonnell 119.) Lockheed engineers therefore decided to use two Bristol Orpheus turbojets on the first prototype, since these provided exactly the right thrust and were available through the American licensees, Curtiss-Wright.

Bristol provided three Orpheus of the B.Or.1/5 type, rated at 4,850 lb. s.t., and these proved to be, in Mr. Kelly Johnson's words, "the best engines the writer has ever used in a prototype aircraft." They were, and are, so good, in fact, that Lockheed decided to make the second prototype, and any subsequent JetStars, capable of using either two Orpheus or four of whatever smaller engine type materialized. Although the J85 is still listed as an alternative, the newer Pratt & Whitney JT12A is now most favoured for the four-engined version. The Orpheus version is fully competitive in performance (except with one engine out) and offers lower cost, simplicity and, to begin with at least, better reliability. Providing for twin- or four-engined installations in the basic airframe incurs a weight penalty of only 35 lb., thanks to the design flexibility of the fuselage pod mounting.

Whilst the basic layout of the aeroplane had been decided, in effect, by the work on the L-193, many details remained to

be decided. Lockheed chose a modest amount—30 degrees—of sweep-back on the wing, and a thickness varying from 12% at the root to 9% at the tip. The size of the fuselage was dictated by the volume necessary to accommodate 10 passengers in first-class comfort, with toilet and galley facilities, and the rear engine location kept much of the fuselage ahead of the wing—with advantage to the view from the cabin. Of importance to the size of the aeroplane was the decision to attach the wing halves to the fuselage frames rather than running them through the fuselage to join on the centre line. For a given floor-to-ceiling dimension, this saved some 12 in. in fuselage diameter and reduced the weight and drag significantly.

To maintain 8,000 ft. equivalent cabin altitude at 45,000 ft. called for a cabin pressure differential of 8.9 p.s.i., the highest of any jet transport so far announced. This, in turn, has required particular care to be paid to the structural integrity of the fuselage, and exceptional care has been taken to prevent explosive decompression. To obtain optimum fatigue strength, 24ST dural skin is used, rather than the more customary 75ST, and small panels prevent tearing.

The relatively poor experience with plastic windows in the Constellation led Lockheed to use safety glass in the cabin windows as well as the cockpit of the JetStar, both to avoid maintenance problems and to prevent cabin decompression.

An unusual, if not unique, feature of the JetStar design, derived from the XF-90 experimental penetration fighter, is the movable fin and tailplane assembly. The tailplane is rigidly attached to the fin, but the fin is attached to the fuselage by a pin through the rear spar, about which it is pivoted to alter tailplane incidence. The remainder of the control system is conventional, with hydraulically boosted ailerons and tailplane and servo-tab-operated rudder, but certain modifications have been made in the light of the flight trials.

Initially, spring tabs were used on unboosted elevators, but tab-elevator flutter developed above Mach 0.76, and no solution could be found to this problem other than providing a simple 3.5 : 1 hydraulic booster. At first, too, boundary-layer control over the single slotted flaps was provided, but flight tests showed that little lift was to be gained at practicable approach engine r.p.m., because of the low pressure ratios of the engines used. Leading-edge slots over the entire span were provided for evaluation, but half-span slats have been found best in practice. A speed brake is located under the rear fuselage, but is not usable during take-off or landing.

Structure and Systems

A preliminary description of the JetStar appeared in THE AEROPLANE for November 29, 1957, and it is necessary here only to summarize the principal features.

The wing has a conventional torsion-box structure and makes use of extruded skin with integral T-section stiffeners. Fuel is contained in integral tanks formed by the torsion box, and each wing half picks up on five heavy frames in the fuselage through a heavy root rib. The fuselage is a straightforward structure with closely spaced circular frames and two heavy keel members for protection in belly landings. The fin has two spars and angled ribs.

The fuel system comprises 1,396 Imp. gallons in the integral wing tanks, plus two external tanks of up to 530 Imp. gallons each. The latter, of sleeve type fitting right round the wing, will probably be used only for military rôles; the civil JetStar can have two 416-Imp.-gallon tanks and the prototypes have also flown with two 250-Imp.-gallon slipper tanks on the wings. Each engine is fed from a separate booster pump and fuel in external tanks feeds into the internal tanks. All fuel-system components are located outside the pressurized area.

Two completely separate 3,000-p.s.i. hydraulic systems are provided, powered by engine-driven pumps, with an electrically powered auxiliary 2,300-p.s.i. system connected to the primary. The primary hydraulic circuit operates u/c, brakes, flaps, speed brake, and nosewheel steering, and half the aileron and elevator boosters, while the secondary circuit powers the other half of the boosters.

Pressurization is by engine bleed air, and two air-cycle cold-air units are installed. A 1,800-p.s.i. oxygen system is provided for crew and emergency passenger use, the cabin installation being of the automatic pop-out type when cabin altitude exceeds 14,000 ft. Air-driven starters in each engine intake-duct bullet provide air at 200 p.s.i. and comprise a self-contained starting system.

Aircraft electrics, designed like the remainder of the aeroplane to CAR 4b requirements, comprise two 15-kVA three-phase inverters (main and spare) supplying 115 V. AC, and two starter generators plus two 12-volt batteries in series, providing 24 V. DC. Fin actuation is electric. Provision is made for Bendix RDR-1D X-band weather radar in the nose, and the prototypes have the Lear L-102 transistorized autopilot.

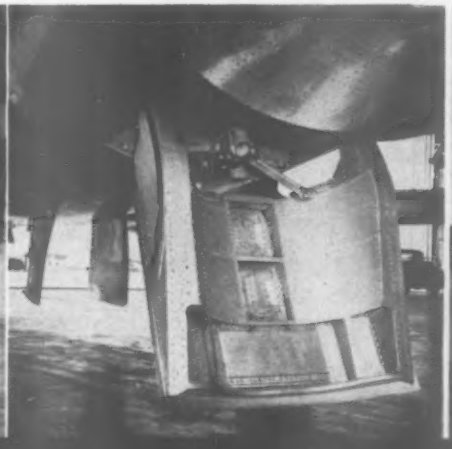
De-icing of the wings and tailplane is by chordwise inflatable boots. The engine inlets are de-iced by engine bleed air and the windscreen is heated by hot air.

As on the Electra, system accessories are grouped for ease of servicing. The electronics compartment is in the nose behind the radome, and hydraulic and air-conditioning systems are in the upper part of the rear fuselage, behind the rear pressure bulkhead and over the baggage compartment.

While the basic 10-passenger layout provides first-class comfort in the cabin and allows space for a toilet and small buffet, it is likely that executive versions of the JetStar will

The cockpit of the JetStar, above, is remarkably uncomplicated. Both prototypes have the Lear L-102 lightweight transistorized autopilot also to be used in the Caravelle. Below, left to right, are details of the main undercarriage with Goodyear tyres and brakes; the ventral speed brake; and the Orpheus engine pod.

Howard Levy photographs



Dimensions and engineering details (left) are common to all versions of the JetStar. Performance data covers the Orpheus (below) and JT12 (right) variants.

Dimensions
Span: 53 ft. 8 in.
Overall length: 60 ft. 4½ in.
Overall height: 20 ft. 6 in.
Gross wing area: 521 sq. ft.
Sweepback: 30° measured at 25 per cent. chord.
Internal cabin dimensions:
Length (ex. flight deck): 28 ft. 0 in.
Max. width: 7'9 in.
Max. height: 7'4 in.
Max. usable volume (ex. flight deck): 716 cu. ft.

Accommodation
Normal: 10 (2 abreast).
Max.: 22 (fore-and-aft benches).

Structure: Two-spar wing in two pieces joined to the fuselage at five points each side. Integral wing tanks between spars, and extruded skin with integral T-section stiffening. Circular section frame and stringer fuselage with 24ST Dural skin.

Undercarriage: Single-wheel main (inwards retracting) and steerable nose (forwards retracting) wheels. Hydraulic brakes. 16-ft. landing brake 'chute (optional). Dual main wheels optional.

Flaps: Full-span slotted, in two portions on each wing.

Air Brakes: Speed brake under rear fuselage.

Flying Controls: Conventional ailerons and elevators with hydraulic boost; rudder has servo-tab control. Tailplane incidence variable by movement of entire fin assembly.

Systems: Two 3,000 p.s.i. hydraulic systems, powered by engine-driven pumps, for aileron and elevator boost, u/c, brakes, nose-wheel steering and speed brake. Two starter-generators and two batteries for 24V DC electrics; two 15 kVA three-phase inverters for 115V AC. Cabin pressurization at 8.9 p.s.i. by engine bleed air. De-icing of wing and tail-plane by inflatable boots; intakes by engine bleed air. Pressure refuelling.

Powerplants
Two Bristol Orpheus 810 turbojets.
Take-off thrust each (I.S.A., s.l.): 5,050 lb. at 10,000 r.p.m.
Silencers and reversers not fitted; no water injection.

Weights and Loadings
Basic operational: 17,055 lb.
Total fuel: 11,229 lb.
Mfrs. normal payload: 2,050 lb.
Normal take-off: 30,334 lb.
Max. landing: 26,000 lb.
Wing loading (normal t-o. wt.): 58.2 lb./sq. ft.
Wing loading (max. landing wt.): 49.9 lb./sq. ft.
Power loading (normal t-o. wt.) 3.0 lb./lb. s.t.

Design Criteria
Design limits: Mc/Vc=.83/370 k. EAS. Mne/Vne=.87/383 k. EAS. Md/Vd=.93/425 k. EAS.

Performance
Recommended cont. cruising speed (I.S.A.): 438 knots (at 45,000 ft. and 26,000 lb.); consumption: 271 Imp. gal./hr.
Approach speed (1.3 Vso at max. landing wt.): 120 knots.
Balanced field lengths (at normal t-o. wt.):
At I.S.A. at sea level: 6,100 ft.
At I.S.A. +15°C. at sea level: 7,450 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,550 ft.
Range (take-off to landing), still air, 2,000 lb. reserve fuel, I.S.A., max. fuel (1,396 Imp. gal.): 1,490 naut. mi. with 2,050 lb. payload at 438 knots (mean) at 43,000 ft. (mean).

Powerplants
Four Pratt & Whitney JT12 turbojets.
Take-off thrust each (I.S.A., s.l.): 3,000 lb. at 16,000 r.p.m.
Silencers and reversers not fitted; no water injection.

Weights and Loadings
Basic operational: 17,401 lb.
Total fuel: 17,929 lb. (with external tanks).
Mfrs. normal payload: 2,050 lb.
Max. take-off: 38,940 lb. (with external tanks).
Normal take-off: 30,680 lb.
Max. landing: 26,000 lb.
Wing loading (max. t-o. wt.): 74.9 lb./sq. ft.
Wing loading (max. landing wt.): 49.9 lb./sq. ft.
Power loading (max. t-o. wt.): 3.25 lb./lb. s.t.

Design Criteria
Design limits: Mc/Vc=.83/370 k. EAS. Mne/Vne=.87/383 k. EAS. Md/Vd=.93/425 k. EAS.

Performance
Recommended cont. cruising speed (I.S.A.): 445 knots (at 45,000 ft. and 26,000 lb.); consumption: 259 Imp. gal./hr.
Approach speed (1.3 Vso at max. landing wt.): 120 knots.
Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 6,750 ft. (3,800 ft.*).
At I.S.A. +15°C. at sea level: 8,150 ft. (4,500 ft.*).
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,420 ft.
Range (take-off to landing), still air, 2,000 lb. reserve fuel, I.S.A., max. fuel (2,228 Imp. gal.): 2,520 naut. mi. with 2,050 lb. payload at 445 knots (mean) at 42,000 ft. (mean).
* At normal t-o. weight.

carry fewer passengers and have more luxurious appointments. In addition to carry-on luggage space, there is a small compartment in the rear fuselage, the loading hatch to which is formed by the speed brake.

For the military, Lockheed have suggested a number of possible rôles, in addition to the 10-passenger transport for high-priority personnel. These proposals cover, in the transport field, arrangements for up to 23 troops, 12 stretchers and two attendants, or over 700 cu. ft. of cargo space, with a reinforced floor and additional loading hatch. Other suggested rôles include navigator-bombardier training; airway and air-communications service (calibration of airport radio, etc.); fighter-interceptor training; electronic countermeasures training; test support missions; and air photographic and charting operations.

Flight Test

The first of the two JetStar prototypes made its first flight on September 4, 1957, followed by the second in March, 1958. The flight trials were conducted at Edwards Air Force Base and in the first nine months the two aircraft accumulated some 300 hours in the air without any significant snags, other than the tab-elevator flutter already mentioned. The total hours flown is now well over 600. In the course of trials the JetStar has been flown to 52,000 ft., to 630 m.p.h., to Mach 0.92 clean and Mach 0.90 with external tanks. On June 17, 1958, the second prototype flew round the U.S.A. in four stages from Edwards Air Force Base in an elapsed time of less than 18 hours at a block-to-block speed of 456 m.p.h. and with the large sleeve tanks fitted. This flight included a stage of 2,530 st. miles, and another test flight has covered 3,105 st. miles in a closed circuit.

Compliance with CAR 4b (and SR422) has been required by the U.S.A.F. from the outset, and much of the basic flying for certification has already been concluded.

Performance details and other data for the JetStar are tabulated above in THE AEROPLANE'S standard form of presentation, for Orpheus and JT12-engined versions. Military models of the JetStar would be able to carry considerably more payload, which is space-limited at 2,050 lb. in the 10-passenger version; cargo versions operating to military requirements, for instance, could lift up to 9,000 lb.

Detailed operating costs have not been published, but Lockheed claim the JetStar will be cheaper to operate than many existing executive types. In a comparative study involving three types of twin-engined and one four-engined business aircraft, the JetStar was estimated to have a seat-mile operating cost of 2.6 cents (with 10 passengers), compared with about 5-6 cents for the twins and 9.3 cents for the four-piston-engined type. These figures assumed 600 hours' annual utilization, 1,500 naut. mile journey and no crew cost, depreciation or insurance. Maintenance costs also compared favourably with those of existing types.—F.G.S.

Lockheed Jet Transport Studies

AS explained in the foregoing article on the JetStar, Lockheed undertook a thorough investigation of large jet transport designs between 1944 and 1953. One result of this investigation was the conclusion that rear engine mountings were to be favoured, and this layout was therefore adopted from the outset for the JetStar.

Lockheed's early design studies were described in some detail by Mr. C. L. Johnson in a paper on JetStar development given before the I.Ae.S. at Los Angeles last July, extracts from which follow:

"While the JetStar aircraft was conceived, engineered and flown in less than eight months time, Lockheed had spent close to $7,000,000 in the preceding 13 years studying large jet transport aircraft. In 1944 preliminary design studies were undertaken to evaluate the application of turbojet power to transports. One of the earliest designs of a small jet transport used normal nacelle installations for the engines. This design was rapidly considered to be obsolete, as more knowledge was gained with jet fighters, so that by 1947 a new concept was being pursued, known as the L-179. The engines were completely buried in the fuselage, with the forward ones exhausting under the wing and the rear ones out the aft end of the fuselage. Boundary layer control around the ducts was to have been used for obtaining proper ram to the rear engines.

"In 1948 this concept had been discarded because of probable noise, vibration and similar problems which might develop with the front engine installation, and all four engines were placed behind the wing in a large, flat pod. This pod was designed with four heavy fore-and-aft longerons, which acted as firewalls, and which also could take a belly landing of the

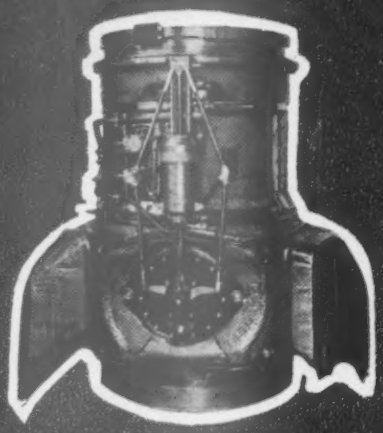
(*Continued on page 75*)

Successful heat exchange and heat insulation

Success in our business doesn't merely mean the ability to manufacture, though we are extremely well equipped, even to the extent of having our own aluminium flux bath brazing plant.

Success to us, means the ability to solve problems ; to produce something that will do a new job, or perhaps an old job in never-before-experienced circumstances. And then, of course, to make it a practical and economical proposition.

We have forty years experience and wide resources. If we can help you in any way with heat exchange and insulation equipment, please contact us. We are always at your service.



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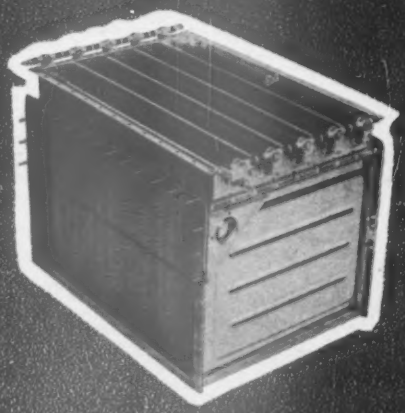

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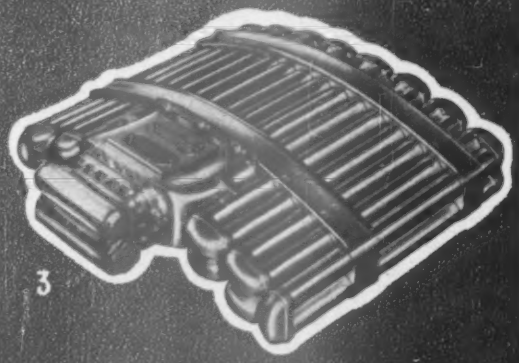

3

1 *These thermal blankets are made of refractory fibre cased in .004 inch (.1016 mm) stainless steel. They are made-to-measure and are extremely light, the dimpled construction being responsible for their great strength. Specified for Rolls-Royce and Armstrong Siddeley jet and turbo-prop engines, these particular examples are shown fitted to the Rolls-Royce thrust reverser for the de Havilland Comet.*

2 *We design, manufacture and supply heat exchangers for many purposes in both aluminium alloy and stainless steel. This particular example is for the Vickers Vanguard's anti-icing system. Similar units are being supplied for the Fokker Friendship, the Bristol Britannia, the Armstrong Whitworth Argosy, the Vickers Viscount and the Handley Page Herald.*

3 *High pressure fuel-cooled oil cooler for high performance gas turbine engines. This unit is used in the Armstrong Siddeley Sapphire S.A.7.*

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A NEW ERA

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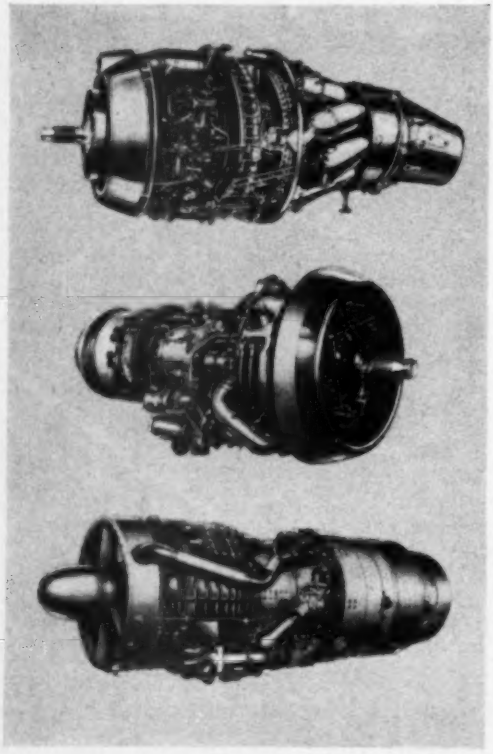
has now been granted a full certificate of airworthiness by the Air Registration Board at a minimum rating of 17,000 lb. thrust. Conways are now being delivered to aircraft manufacturers.

ROLLS-ROYCE EXPERIENCE IN THE AIRLINE OPERATION OF GAS TURBINES IS UNIQUE.



THE DART

—the first, and for four years the only prop-jet in airline service has flown over 6,000,000 hours. The Dart is currently operating at overhaul lives of up to 2,200 hours.

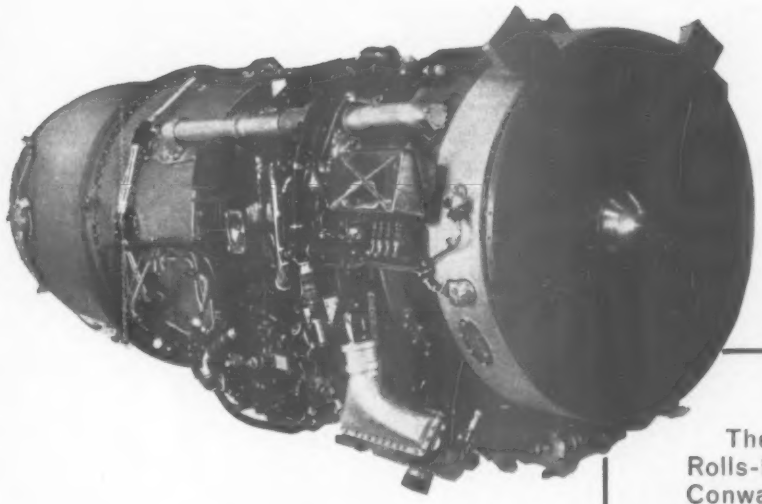
THE TYNE

—a most advanced prop-jet engine, is due to enter service in 1960 at ratings of 4,985, 5,525 and 5,730 e.h.p. It has a specific fuel consumption comparable with the latest compound piston engines.

THE AVON

—the first turbo jet on the North Atlantic route, and now in daily service, began scheduled operations with an approved overhaul life of 1,000 hours.

IN JET POWER



DEVELOPED FROM EXPERIENCE

The by-pass principle which Rolls-Royce have proved in the Conway engine is now accepted as the correct formula for all jet transport and for certain military applications.

The new RB.141 family of by-pass jet engines is based on seven years' development experience of the by-pass principle gained with the Conway and on six years' operation of other gas turbine engines in airline service. The first of this series has already been chosen to power the new British European Airways medium range jet airliner.

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16 PASSENGER

Twin Pioneer

POWERED BY ALVIS LEONIDES ENGINES
FITTED WITH DE HAVILLAND PROPELLERS

(*Continued from page 74*)

aircraft without damage to the engines. A great deal of study was put into this design and many wind-tunnel tests were run. There was considerable fear that lining up four engines in a row might lead to catastrophic failure of the whole powerplant system should a turbine disc split and a piece go through the other three engines. Ditching was considered to be a problem and it was necessary to provide inlet duct closure doors for acceptable ditching characteristics.

"In 1951 and 1952 the engine package was split up and moved up above the wing and the engines staggered at each nacelle. By this time the design was known as the L-193. A mock-up of the engine installation and cockpit was built. The air intake in the final configuration was located above and slightly forward of the wing trailing edge, leaving ample room for a boundary-layer bleed. Wind-tunnel tests on this installation indicated very satisfactory inlet conditions and drag.

"It will be noted that the major change in configuration which had taken place during this design evolution had to do with the powerplant installation. The basic problem of wing planform was resolved at an early date. Because it is desirable to cruise as close to Mach 1 as possible with a subsonic aircraft, and yet a large wing fuel volume is necessary, the swept wing did not have much competition from either the thin straight wing or the delta. The latter was ruled out because of the desirability of a reasonably high aspect ratio.

"To obtain some information as to the relative crash safety of the pylon-mounted nacelles compared to the aft fuselage mounting above the wing, a number of scale models were subjected to crash fire tests. While these tests are relatively crude, the outstanding results showed that when the wing of an aircraft is kept free of nacelles the aeroplane can withstand a substantial crash without causing a fire.

"Summing up some very extensive studies, the rear engine mounting for jet powerplants seemed to have the following advantages over pylon-mounted engines located normally on a wing:

"1. Substantially greater safety, particularly in a crash landing.

"2. Substantial advantage in cabin and exterior noise. (The fuselage shields some noise effects for many angles around the aircraft.)

"3. Excellent drag characteristics.

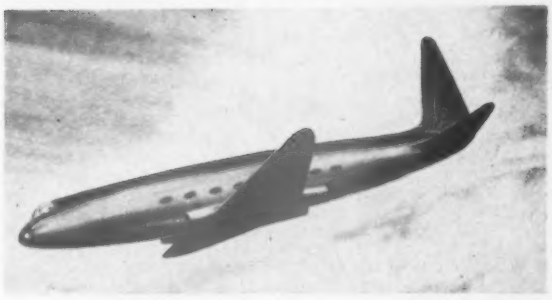
"4. Protection of the inlets from stones and ground objects, particularly when the inlet is kept forward of the trailing edge of the wing.

"5. Improved maximum lift, due to the use of uninterrupted flap span.

"6. Substantially simpler systems, in terms of control routing, length of air ducting, electrical leads, etc.

"7. Favourable balance, which results in placing much of the fuselage ahead of the wing, so that more passengers obtain a good view.

"8. When properly placed over the wing, the wing acts as a guide vane to direct the inlet flow. For a change of angle of attack of the aeroplane of approximately 19 degrees, the change of angle of attack into the nacelle is less than 3 degrees.



One of the earliest Lockheed jet transport designs, in 1944, used normal nacelle installations for the engines.

"9. The high location of the inlet in a protected location provides safety to the ground-crew members when walking around the aeroplane when engines are running.

"10. The ditching characteristics are improved by not having the nacelles located where they can dig into the water.

"11. A failed turbine wheel cannot go through the pressurized area of the fuselage or fuel tanks.

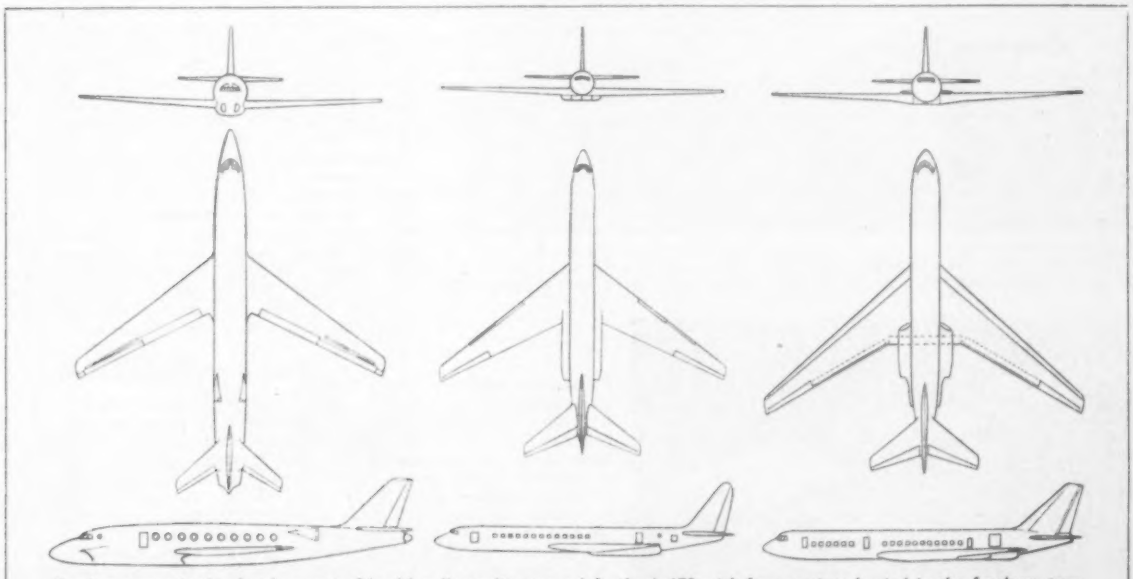
"12. The offset thrust after losing an engine is very low, so that an improved one-engine-out climb and control are available. Holding in a traffic pattern can readily be done with one-half of the normal powerplants out of operation, as all aircraft flight characteristics remain essentially unchanged.

"Proponents of pylon-mounted wing nacelles bring up the following objections to fuselage-mounted pylons:

"1. The engine weight is not available for reducing wing bending moments and acting as a flutter counterbalance. They claim lighter structural weight with the wing nacelles. Any slight difference in this regard, I feel, is completely cancelled by a saving in flap complications and system weights, described above.

"2. When the double fuselage pod is used a failure of a turbine disc in one engine might knock out another. The writer does not feel this problem to be in any manner acute, and is more than balanced by other improvements of safety, such as not having a hot disc go through a wing spar, a fuel tank, or passengers. Again, the problem of gear-up landings with the wing installation certainly merits a great deal of consideration.

"The L-193 was well worked out by 1953, when efforts were made to sell the aeroplane to various airlines. Many airlines, such as Pan American and Air France, were very much impressed with the L-193. Lockheed was unable to get orders, however, to carry the programme forward. The huge financial risk which must be undertaken to develop a 280,000-lb. transport was the final deterrent factor which kept Lockheed out of the large turbojet passenger field."



Further stages in the development of Lockheed's studies were, left, the L-179 with four engines buried in the fuselage, two forward and two aft; centre, another L-179 study with engines four-abreast behind the wing; and right, the 280,000-lb. L-193 of 1953, with two engines each side behind the wing.

News of Industry

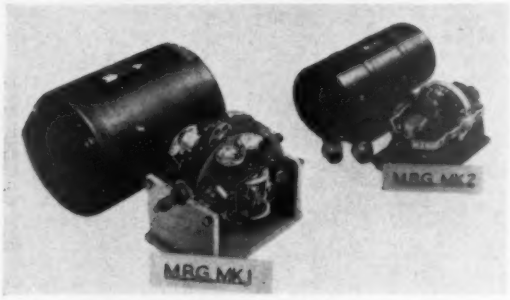
Navigational Reference Gyros

SINCE the brief note on the Mk. 2 Master Reference Gyro (M.R.G.) produced by S. G. Brown, Ltd., of Watford, in THE AEROPLANE of November 28, 1958, further information and development details have been obtained. As with the company's earlier Mk. 1 M.R.G., the Mk. 2 is suitable for feeding roll, pitch and azimuth information to any airborne equipment in the form of electrical outputs. If it is intended to use the M.R.G. as part of a navigational system a computer can be provided to introduce into the unit the appropriate signals to allow for the Earth's rotation and other accelerations.

The approximate size of the Mk. 2 M.R.G., including its mounting frame and amplifiers, is 14 in. long by 7 in. wide by 8¼ in. high, and the complete unit weighs about 20 lb. As the vertical and azimuth gyroscopes are now set in tandem (in line with the fore-and-aft axis of the stabilized platform) it has been possible to increase their wheel diameters over the size of the gyros in the Mk. 1 M.R.G. to give better efficiency. This arrangement of the gyroscopes also reduces the time required for the platform to turn through 180° at the moment when the longitudinal axis of the aircraft is vertical. The rate of roll exceeds 450°/sec.

Tests on the gyros have confirmed random wander rates of better than 0.25°/hr., and the company has stated that the vertical reference accuracy is 0.2°. The erection time constant is approximately 2 min.

One result of the recent agreement between the American Bosch Arma Corpn. of New York and S. G. Brown, Ltd., is a design study, which is already in progress, on the Brown Mk. 3 M.R.G. This instrument will use a pair of Arma-Brown floating gyros with two degrees of freedom, and it is intended that it will be accurate enough for inertial navigation purposes.



The two models of Master Reference Gyro developed and manufactured by S. G. Brown, Ltd., showing the difference in size between the Mk. 1 and Mk. 2. A design study is in progress on a Mk. 3 M.R.G. for inertial navigation applications.

Component Assembly

TO overcome the problems of obtaining clean air for the assembly of miniaturized and precision components, the British Manufactured Bearings Co., Ltd., of Crawley, Sussex, developed a pressurized assembly cabinet. Last year a separate company—John Bass, Ltd.—was formed to manufacture the unit and two types of self-contained cabinets are now produced.

The first type, the standard, can be used for production work or the testing of components. The working principle involved is that a fan draws air in through a filter, and that as the orifice in the front is smaller than the channel of air in the cabinet, the interior is slightly pressurized. This pressure prevents any pollution from entering the front of the cabinet, and also forces to the base of the cabinet any particles which may be inside.

A number of filters can be fitted in the cabinet, the most efficient of which will give a filtration of 2 microns. The interior is lighted by a 60-W. strip light, and a thermostatically controlled strip heater can be incorporated to warm the air to approximately 65° F. before it is blown into the working chamber. The blower is powered by a .08 h.p. AC motor.

The second type of cabinet is the production bench model, which is designed primarily for use on assembly lines and has been adapted to fit a normal working bench. It also has special removable side plates so that intercommunication can be provided between cabinets. Interior lighting, heating and pressurization are as for the first type.

Pressurized assembly cabinets developed by the British Manufactured Bearings Co., Ltd., for the assembly of miniaturized and precision components. These are supplied either as mobile self-contained units or in batteries of 2-5 cabinets for production lines.

Ferranti Flight Instrumentation

FOLLOWING the adoption of the Ferranti standby artificial-horizon system by B.E.A. and B.O.A.C. for their Vanguard and Comet fleets, Ferranti, Ltd., announces that orders for the system have been received from B.O.A.C. for its future Boeing 707-436 fleet. A number of the units have already been delivered to the United States for installation.

Normally, the system operates from a 115-V. 400-c.p.s., single-phase AC supply, but in an emergency it will continue to operate, or start up and operate, from 21-29-V. DC supply. Changeover to DC operation is automatic on failure of the AC supply.

The complete system consists of a 3½-in. artificial horizon type FH7D and a type F13 control/inverter unit. The latter unit contains a transistorized static regulator and transistorized static inverter which provide the single-phase AC power from a 21-29-V. DC supply. The unit also includes an automatic changeover circuit and a control section, the latter including a relay which is operated by a push-switch on the front of the horizon. When the switch-push is depressed a fast rate of erection for the gyro is obtained, providing 120°/min., as compared with a normal 3°/min.

A power-failure indication circuit is included in the control section, and it also operates a gimbal-centring device fitted to the horizon. This latter unit ensures that the outer gimbal settles at the vertical datum when the supplies are switched off.

Swedish Starter Unit

SCANDINAVIAN Airlines System has ordered 10 air-compressor units from Atlas Copco, of Stockholm, for the ground starting and servicing of their fleet of DC-8 jet transports.

The Air Partner unit is produced in two forms by Atlas Copco. The basic unit, the M-2, consists of a Lysholm rotary-screw compressor driven by a 280-b.h.p. Ford V-8 petrol engine via a built-in gear and centrifugal coupling. The Air Partner M-3, which is the version ordered by S.A.S., is made up of two M-2 units coupled in parallel.

Both versions are designed for starting the engines of aircraft with air-turbine starters. The M-2 will also supply air for limited air conditioning, while the greater air supply of the M-3 can also be used for air conditioning, de-icing and checking auxiliary systems. When used for ground heating or cooling of aircraft cabins, the Air Partner M-3 supplies heated compressed air which is suitably processed by the air-conditioning system of the aircraft concerned.

The Air Partner M-3 can deliver a continuous airflow varying from 200 lb./min. at 35 p.s.i.g. to 190 lb./min. at 50 p.s.i.g. when a supply is needed for ground air conditioning or checking pneumatic services. For engine starting a larger supply can be provided for a short while; the output then varies between 240 lb./min. at 35 p.s.i.g. and 230 lb./min. at 50 p.s.i.g. The output of the M-2 is half that of the M-3.

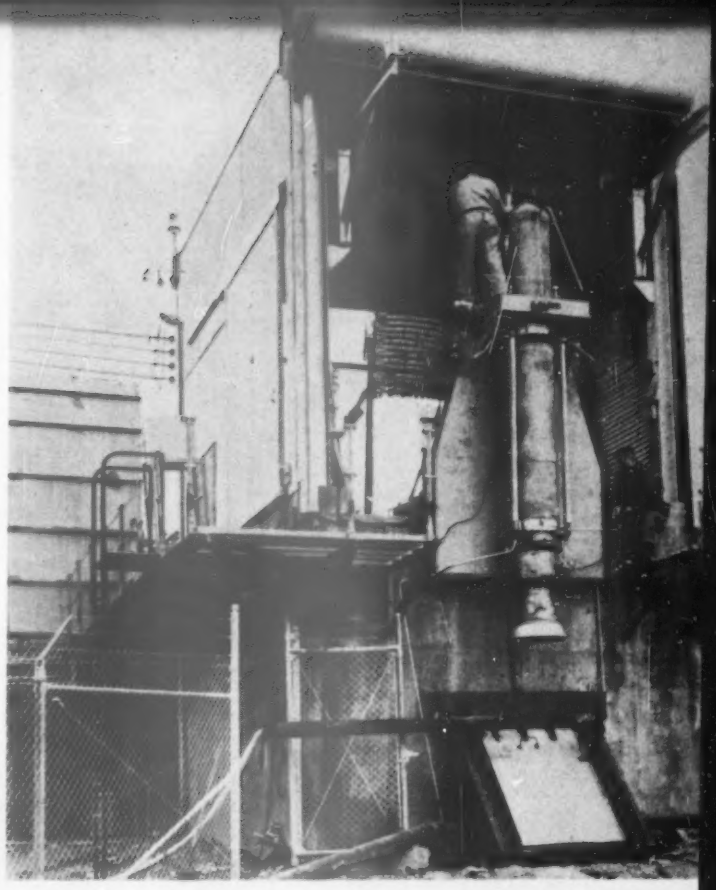
Ducted Aluminium Sheet

The Northern Aluminium Co., Ltd., of Banbury, recently introduced a new product—Noralduct—a solid aluminium sheet having internal systems of passages and ducts. Particularly designed for all types of heat-transfer equipment it is manufactured by superimposing a sheet of Noral alloy on another, on which a foreshortened impression of the required tubing pattern has been printed, and then passing these sheets through a rolling mill. The printed areas are then hydraulically inflated, becoming ducts and chambers in solid sheet.

New World Photo-news

Pictures from Howard Levy

Below, Mel Stickney, a P.A.A. captain and racing and glider pilot, has fitted a quickly removable 65-h.p. Lycoming engine to a Laister-Kauffman LK-10A sailplane to avoid dismantling it and transporting it by road. In this form the aircraft weighs 894 lb. and has a maximum speed of 109 m.p.h. A "do-it-yourself" kit is available.



Above, pre-packaged liquid-propellent rocket powerplants have been produced by the Reaction Motors Division of the Thiokol Chemical Corpn., of Denville, N.J. The 50,000-lb. thrust prototype is here seen on the test stand.

Right, this Cessna 310B is used for cloud-seeding by the Commonwealth Scientific and Industrial Research Organization in Australia. One of the silver-iodide burners can be seen under the starboard wing.

Below, test flights of the AN/USD-2 surveillance drone, produced by the Defense and Technical Products Division of the Rheem Manufacturing Co., of Downey, Calif., are under way. This picture shows the drone on its launching truck, with the propeller-swinging starter in position.

Below right it is seen in the launching position. The powerplant is a 180-h.p. Lycoming/Rheem flat-four engine with a G.C.R. Arrow booster rocket on each side of the fuselage.

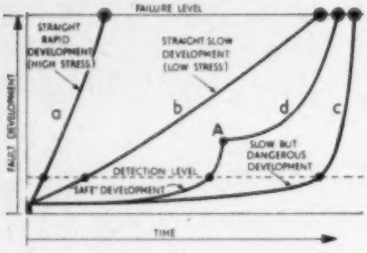
From the Lecture Room

Design for Helicopter Safety

BOTH design philosophy and practice which aim at producing safe helicopter mechanisms were described in detail on January 8 by Mr. R. Hafner, chief designer, helicopters, of Bristol Aircraft, Ltd., in a Royal Aeronautical Society lecture. Some of his main points are given below.

Mr. Hafner mentioned that in 1954 he had stated his belief that the compound helicopter held the key to fast, short-haul transport over ranges up to 300 miles and that beyond this range the convertible helicopter might take over.

Today he held the same view, but the compound helicopter had crystallized in his mind as a tandem-rotor configuration with a small wing placed in the gap between the rotor slipstreams, and with the turbine exhausting aft at high cruising speed to augmentate propulsion. It had shaft-driven rotors. This and other VTOL aircraft depend almost entirely on the extensive use of mechanisms.



Four types of fault-development history are shown; the one marked "d" is the most desirable and can be achieved by fail-safe design. Examples are the use of two links in parallel or two bearings in series; failure of one is shown at point A.

In the past, mechanisms have received comparatively little attention and have been regarded by the classic aeroplane engineer—essentially an expert on structures—as unreliable and to be avoided wherever possible.

Differential Safety Standards

An important concept in the philosophy of safety is the "safety standard." This standard is not a scientific one; it is mainly a matter of individual or of public opinion. Different safety standards are accepted by the public for everyday rail travel and, say, a seaside donkey ride.

It is clear that there is no such thing as a common standard of safety. There seems to be nothing unethical in the idea of differential standards of safety in the air-transportation field, provided, of course, that the travelling public is aware of such differences.

Two standards are suggested, one for the well-established means of air transportation which achieve a high annual aggregate of passenger miles, and a lower standard for—as yet—novel means of air transportation, which are still in the introductory stage and achieve only a relatively small number of passenger miles per annum. Both means of transportation, with their respective characteristics, fulfil a public need.

The "cost" of safety is not merely the cost of procurement, but it includes also many other penalties, such as loss in performance and reduced useful life. An acceptable definition would be the "cost of operation per unit of service rendered."

A moderate measure of safety can be obtained at relatively low cost. But with decreasing hazard the cost increases progressively. Cost curves for different hazards are essentially empirical. But even if comprehensive data were available, the balancing of a design for a minimum of "cost" commensurate with a specified safety standard will greatly depend on the designer's ability to evaluate numerous factors some of which are imponderable.

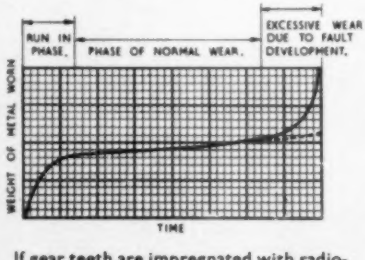
Early in the life of a working unit built-in faults lead to the familiar teething troubles; then come the random faults, which appear during the major part of the working life, and finally come the faults of age. At regular intervals come "vertical fault detectors," which are the routine inspections. These can detect and stop all faults which at the time of the inspection have reached a level of development above that of detection.

The development level of a fault at discovery depends on the detection level of the inspection, the time between consecutive inspections and the shape of the fault development curve in this time interval. Short periods between inspections, combined with low detection levels, are desirable and steep rises in the development of faults must be avoided.

Another form of fault detector is the "horizontal" one. It represents a warning signal obtained either from direct observation or through warning devices. These detectors operate continuously throughout the life of the unit and not just at regular intervals, but keep only a limited area of the working unit under observation. Such warning devices are particularly effective in the case of faults which tend to develop abruptly.

Detectors of this type can indicate incipient failure in bearings and gears. The break-up of a bearing starts generally with a deterioration of the bearing surfaces and a distinct rise in the bearing temperature. A bearing-temperature indicator close to the critical surfaces can show up the fault at an early stage.

A radioactive wear-detector can give early indication of wear on gear teeth and bearing surfaces. Gear-tooth faces and bearing surfaces are impregnated to a depth of about 0.005 in. with radioactive carbon or radioisotopes of other



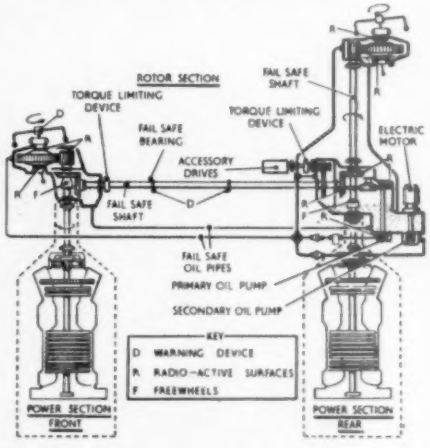
If gear teeth are impregnated with radioactive carbon, the radioactivity of the oil which lubricates them depends on the rate of tooth wear. Warning of a fault is given by a rapid increase in radioactivity.

suitable elements. This renders the parts slightly radioactive, but does not prevent their handling and assembly by normal methods.

Radioactivity of the oil in the system can be detected by fitting in the oil filter a suitably shielded Geiger counter showing on a cockpit instrument the level of radioactivity or the rate of change of such activity.

After the gears have been run-in satisfactorily, radioactivity of the oil will level off and remain almost constant, until the development of a new fault produces new wear and further rise of radioactivity.

An *in situ* crack detector offers an early indication of fatigue cracks in certain mechanical components. These



This power and transmission system for a tandem-rotor helicopter makes full use of the fail-safe design features advocated by Mr. Hafner.

are designed so that the stress-carrying parts form the walls of a container which can be subjected to a pressure test with a suitable liquid, such as oil. A sound part will hold this pressure, but one with even a small crack will lose pressure rapidly. This simple testing method can be used in conjunction with fail-safe mechanical components.

A particularly undesirable form of fault-failure history is one in which the fault remains below detection level for some time and then suddenly rises to failure level—highly stressed bearings are an example; they fail suddenly without much warning. A very desirable form of fault-failure history, on the other hand, is one in which the fault development is arrested over a definite period, after which it rises again until failure level is reached.

Such a form can be obtained, without a serious weight penalty, by methods of design such as arranging two links in parallel or two bearings in series. Safe mechanical components designed on these lines are the floating bush and bearing, each of which gives two rotational freedoms for the shaft concerned.

Other applications of this design philosophy are the use of wide gear teeth, which lessen the likelihood of complete teeth being lost through fatigue failure; duplicated articulations for rotor blades, such as the segmented tie-rods used on Bristol helicopters; double-walled shafts for torque transmission and double-walled oil pipelines; and the use of load-limiting devices.

Such fail-safe mechanisms, in conjunction with suitable methods of fault detection, can achieve a very high degree of safety. There has been a shift in emphasis from "safety through freedom from faults" to "safety through timely detection of faults."

THE

VULCAN

GETS

NEW

STRIKING

POWER

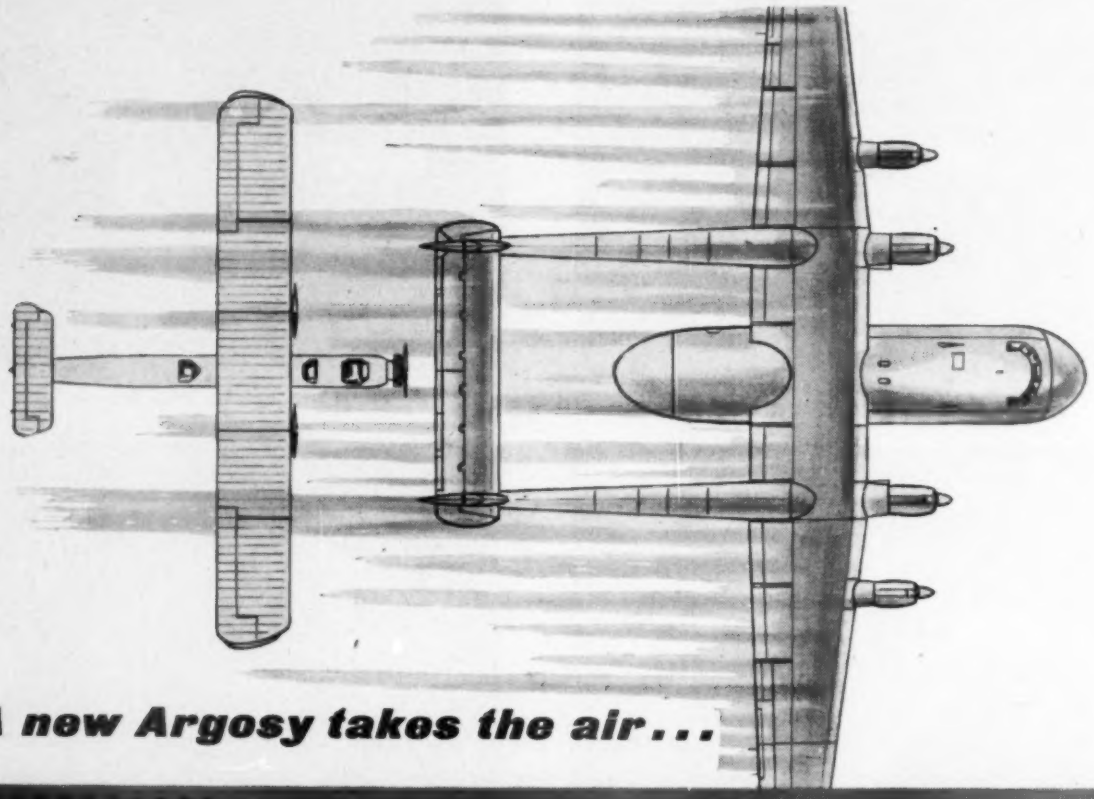
AVRO STAND-OFF BOMB GIVES V-BOMBERS EXTRA FLEXIBILITY IN ATTACK

Britain's most advanced V-bomber, the new Avro Vulcan B. Mk. 2, due to enter service with RAF Bomber Command next year, will be equipped to carry one of the most powerful weapons ever invented for the preservation of peace. This is the Avro Stand-off bomb, first air-to-ground guided missile to be developed in this country, which is designed to destroy an enemy target without the aircraft having to penetrate the ring of defences. Designed and built by the Weapons Research Division of A. V. Roe, the Stand-off bomb gives new power to the Avro Vulcan which becomes an even more formidable bulwark against aggression.

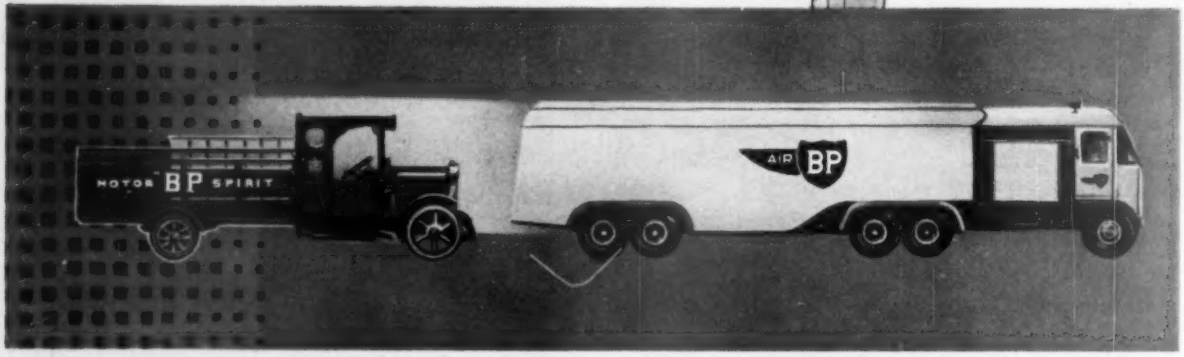
AVRO VULCAN

POWERED BY BRISTOL OLYMPUS ENGINES

A. V. ROE & CO. LIMITED, MANCHESTER/*MEMBER OF HAWKER SIDDELEY AVIATION DIVISION*



A new Argosy takes the air...



...on BP fuel

Built as a far-sighted venture by one of Britain's great industrial groups, Hawker Siddeley, the new Argosy comes nearer to being all things to all men than any aircraft that has gone before. Freighter-coach, air-ferry, airbus, military transport — in its various forms the Argosy will be all of these, heralding a new era of low-cost air transportation in the 1960's.

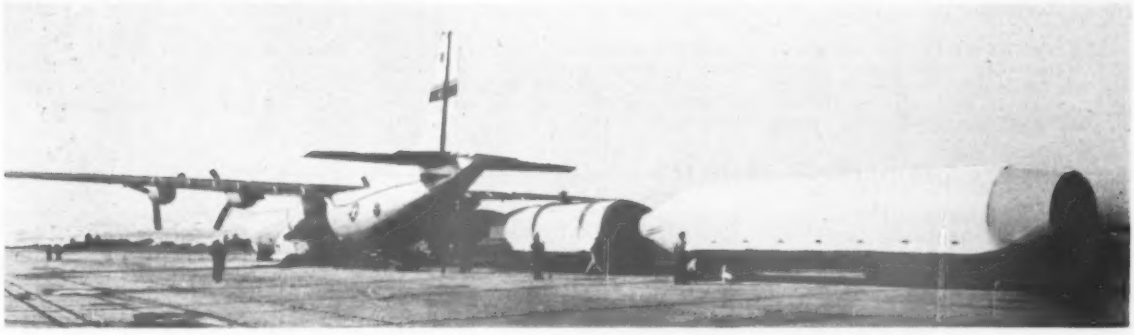
For the Argosy's all-important first flight, Armstrong Whitworth chose AIR BP, the pioneers of turbine fuelling. Big advances in the air in fact are possible only because essential services keep pace on the ground.

AIR BP does just this. Its latest 10,000 gallon Super Fuellers deliver 750 gallons a minute — a motorist's "Five gallons, please" in less than half a second! Its hydrant systems pipe fuel underground at even higher speeds right to the aircraft. In these and countless other ways, AIR BP is preparing today to keep 'em flying tomorrow.

AIR BP

THE AVIATION SERVICE OF BRITISH PETROLEUM

News of Aircraft, Engines and Missiles



MISSILE MOVEMENT.—An ICBM was transported by air for the first time when a Martin Titan was flown from Denver, Colorado, to Cape Canaveral, Florida, in a Douglas C-133 Cargomaster. The missile is about to be loaded into the aircraft.

VTOL PARASITE.—At its Marietta factory, Lockheed is developing two prototypes of its GL-224 Hummingbird, a small jet-deflection VTOL which can be launched and retrieved in flight by a C-130 Hercules. Powered by two Fairchild J44 turbojets, it has already made tethered hovering trials.

ULTRA LIGHT.—One of a number of Hughes 269A two-seat helicopters which are being evaluated by the U.S. Army under the designation YHO-2HU. Latest modifications include a braced tubular tail boom replacing the welded-steel structure on the prototype, and an increase in the width of the cockpit and the length of the landing skids.

Howard Levy photograph

B-70 PRODUCTION. — Lockheed's Georgia Division is to design and build the aft fuselage section for the North American B-70 Valkyrie Mach-3 bomber ordered for the U.S.A.F. The Boeing company will build the wing and Chance Vought the tail unit. The B-70, designed as a successor to the Boeing B-52, is to have intercontinental range and a ceiling of more than 70,000 ft.

ROCKET PLANET.—The Russian Moon-probe rocket launched on January 2 is now in orbit round the Sun. At the extreme points of its elliptic orbit the rocket will be 91 million miles and just over 122 million miles from the Sun. Each orbit will take 450 days and it will be five years before this "10th planet" again comes within observable distance of the Earth.

J83 CANCELLED.—A U.S.A.F. contract with the Fairchild Engine and Airplane Corpn. for the development of the 2,000-lb. thrust J83 turbojet has been cancelled. This engine, on which $58 million had been spent, was intended for the Fairchild Goose decoy missile which, as already announced, has also been cancelled.

TRANSATLANTIC MEMORIAL.—The G.A.P.A.N. announces that on June 15, the 40th anniversary of the first direct crossing of the Atlantic by air, a memorial to the two men—Alcock and Brown—will be unveiled at Clifden, Co. Galway, near where the Vickers Vimy landed. The memorial, which is to be erected by Aer Lingus, will be a 15-ft. high cairn of cemented stones with a 10-ft. base, placed on the Errislanan Road, 1½ miles from the actual landing point.

ROTOL U.S.A. SERVICE.—An agreement has been signed between Rotol, Incorporated (Rotol, Ltd.'s, American subsidiary) and the Aircraft Service Shops Section of the General Electric Company. This provides for complete overhaul and repair facilities for Rotol "turbo-propellers" and gearboxes, in the U.S. This service is already available at North Bergen, New Jersey and Seattle, Washington; and early this year will become available at Ontario, California. Bases at Cincinnati, Ohio and Arkansas City, Kansas, are planned.

VOLTIGEUR LOST.—Lt.-Col. Roger Carpentier, chief test pilot of the Centre d'Essais en Vol, Bretigny, was killed on January 9 when the second prototype S.E.116 (two Turboméca Bastan turboprops) flying from Istres, crashed near Marseilles. Also killed were Eng. Grouzet and Mech. Hochet.

CARAVELLE DE-ICING. — Test sections of the Caravelle's wing and tail unit leading edges are being incorporated in a Lincoln flying test-bed by Napier's at Luton for de-icing trials next month. The Caravelle is to use the company's Spraymat system.

G.91 PROGRESS.—Flight testing of two new variants of the Fiat G.91 lightweight fighter have been in progress for some time, in Italy and the U.K. The G.91R, with a modified nose containing three cameras but otherwise identical to the standard fighter-bomber, has been undergoing operational trials at Caselle airfield, Turin. A pre-production G.91 was also modified to take several navigational systems, including Decca and Rho-Theta, and, as the G.91N, has been tested by NATO personnel in Britain. A G.91 is to go to Bristol Aero-Engines shortly for development testing of the Orpheus installation.

X-1 MODIFIED.—Twin ventral stabilizing fins, similar to those on the Chance Vought XF8U-3, have been added to the Bell X-1E for NACA flight tests at Edwards A.F.B.

NORTHROP TALON.—U.S.A.F. has adopted the name Talon for the Northrop T-38 advanced supersonic jet trainer now in the flight test stage.

LAS VEGAS VISITORS.—According to the European representative of the forthcoming World Congress of Flight at Las Vegas, Avro Aircraft and Orenda Engines from Canada and the Rolls-Royce company from this country are to be among the exhibitors. More than 90% of the major U.S. aviation companies, he reports, intend to participate.

NEW RONDONE.—A three-seat version of the F.4 Rondone two-seater, known as the Picchio, is being developed in Milan. It will be an all-metal aircraft powered by a 160-h.p. Lycoming engine.

JODEL PRODUCTION.—The Société Aéronautique Normande (S.A.N.) has granted manufacturing rights of the two-seat Jodel D.117 to the Alpavia Co., of Gap. Since the beginning of this year Alpavia has been building the D.117 at the rate of two a month. S.A.N. will now concentrate on building the DR.100 three-seater and the D.140 Mousquetaire four-seater.

Commercial Aviation Affairs

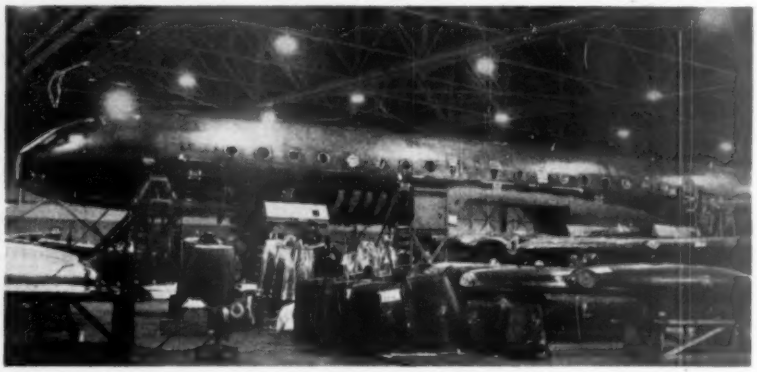
TURBOJET ATTRACTION.—Since the start of North Atlantic services (in late October between New York and Paris and in mid-November to London) Pan American Airways had, by the end of 1958, carried 19,557 passengers in their Boeing 707-121s. Using their smaller-capacity Comet 4s, and carrying first-class passengers on the London-New York run only, B.O.A.C.'s passenger figure at the end of the year was 3,913.

DERBY CUSTOMS.—Customs facilities are to be made available at Derby airport and will be provided before Easter. Services by Derby Aviation from the airport to the Continent will not in future have to clear customs at Birmingham.

AVIATION EXCHANGE NEWS.—In its first week of business, ending on January 6, Aviation Exchange Inc. received 37 bids and offers for 110 aircraft including DC-6s and F-27s. More than 100 members have now been enrolled.

STRIKE OVER.—The strike of flight engineers against Eastern Airlines ended on January 1 after 38 days, when the company agreed to keep engineers on the flight decks of the new jet aircraft for at least the next two years. ALPA called off its strike of pilots against American Airlines on January 10 after 22 days. Terms of the agreement have not been published but involve concessions to the pilots on wages and working hours.

FRIENDSHIP HOURS. — By mid-December production Friendships had flown 4,156 hours, made up as follows: Aer Lingus (3 F-27s) 598 hr.; Braathens S.A.F.E. (1) 24 hr.; West Coast Airlines (5) 2,091 hr.; Piedmont Airlines (6) 665 hr.; Quebecair (2) 297 hr.; Aerovias Venezolanas (2) 361 hr.; and Northern Consolidated (2) 120 hr. The two F-27 prototypes have flown 660 hr. and 747 hr. respectively. The first now has Dart RDa.7s and the second has weather-radar installed.



COMET VARIANT.—B.E.A.'s first Comet 4B is seen here on the assembly line at de Havilland's Hatfield factory before the mating of wings and fuselage.

LUFTHANSA LOSS.—A Super Constellation of Lufthansa crashed and burnt after overshooting the runway at Rio de Janeiro international airport on January 11. Twenty-nine passengers and seven crew were killed; three of the crew survived. The aircraft was on the regular service from Hamburg.

AUSTRALIAN CHANGE.—Southern Airlines, which ceased operations because of financial difficulties on November 1 last, is expected to be bought by Ansett-A.N.A. early this year. The annual general meeting of Southern decided to recommend shareholders to accept an Ansett-A.N.A. offer of £30,000.

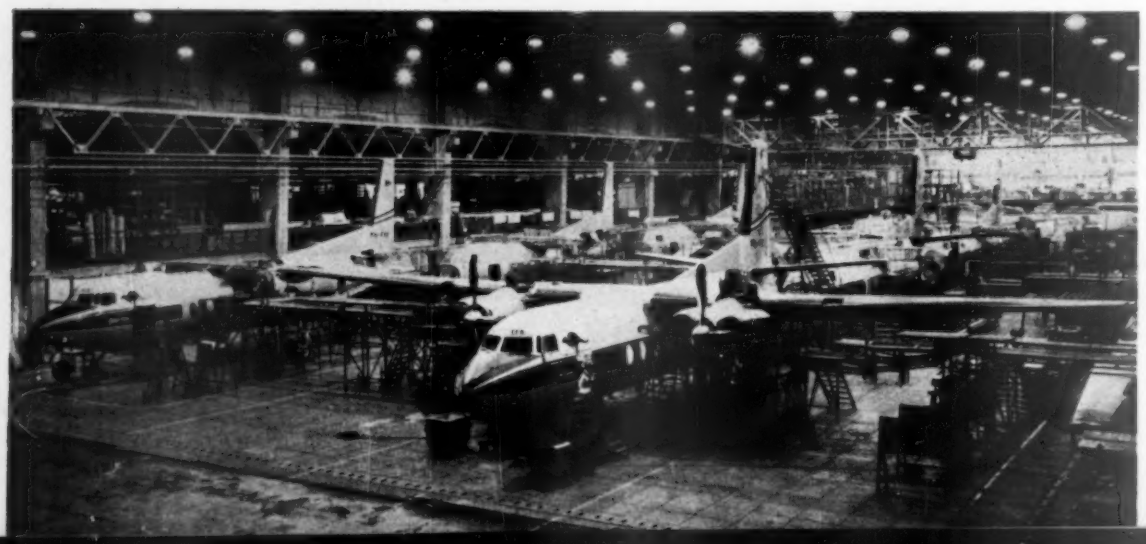
B.E.A. BOOKING DEPOSIT. — In order to reduce the number of "reserve bookings" made by passengers to the Channel Islands, which frequently are not taken up, B.E.A. has introduced a £1 booking deposit on all seats on these services. If the ticket is not used, the deposit is returnable only if a medical certificate is produced. B.E.A. already imposes a 25% "no-show" penalty on single-journey fares (minimum £2).

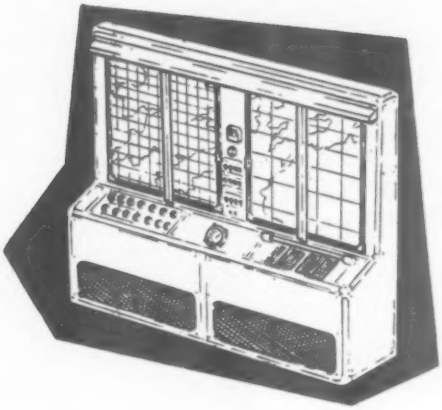
AIRPORTS IN OCTOBER.—Air Transport movements at U.K. airports during October, 1958, increased by 5.3% over the previous year and the number of passengers handled increased by 8.1%. Freight picked up and set down increased by 24% to 13,882 short tons.

BID TO BUY BLACKBUSHE.—The M.T.C.A. is to seek Parliamentary permission to make a compulsory purchase of Blackbushe Airport, which is due to be de-requisitioned at the end of this year. Blackbushe is expected to remain the third major London airport.

(*Continued on page 81*)

DUTCH PROGRESS.—F.27 Friendships (Rolls-Royce Dart turboprops) are seen here in production at the main Fokker factory at Schiphol. In the assembly line are aircraft for T.A.A. (at the front), Braathens and Aer Lingus.





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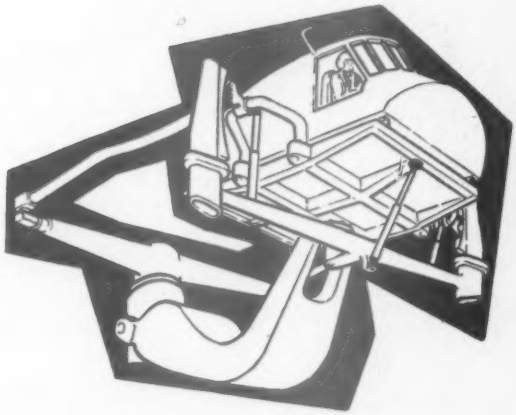

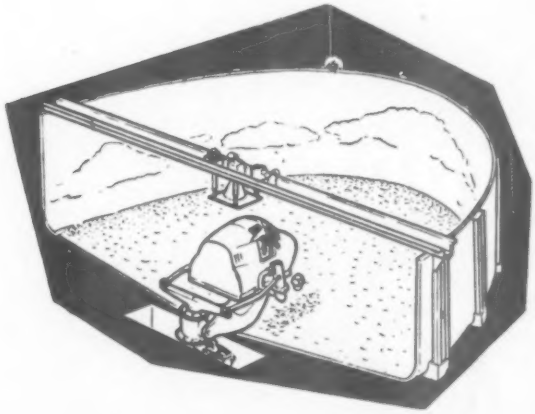

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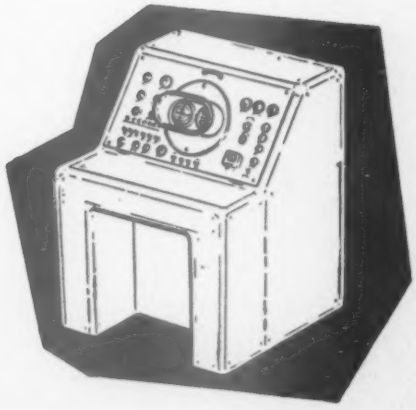

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News About People

(*Continued from page* 80)

JABLO BOARD. — Jablo Plastics Industries, Ltd., incorporating Jablo Propellers, Ltd., and Moulded Components (Jablo), Ltd., announces that Lt.-Col. Harry Delacombe, O.B.E., has retired from the board because of ill health. Mr. W. Dunn, who joined the company in 1942 and who has been assistant to Mr. Bruno Jablonsky since 1946, is elected to the board. Col. Delacombe, who has been in a nursing home near Brighton for many months, is aged 86 and was one of the first air correspondents, serving *The Times* from 1907 to 1910.

GENERAL MANAGER.—Acheson Industries (Europe), Ltd., has announced that Mr. C. R. Wills, B.Sc., has been appointed general manager of Acheson Colloids, Ltd., Plymouth.

PROMOTED.—Mr. J. J. Furniss has been appointed Director of Civil Aviation for East Africa. He has been Assistant Director since 1955.

JUBILEE CELEBRATION. — Mr. H. M. Woodhams, managing director of Sir W. G. Armstrong Whitworth Aircraft, Ltd., was honoured at a brief ceremony on January 13 to mark his 50 years in aviation. Present to pay their respects were Sir Thomas Sopwith and Sir Roy Dobson; recorded tributes by Sir Geoffrey de Havilland, Sir Alan Cobham and Mr. Frank Courtney were played.

B.O.A.C. APPOINTMENTS. — Mr. Gilbert H. C. Lee has been appointed chief commercial manager of B.O.A.C. and will be responsible to the managing director for the development of the Corporation's overall commercial policy. He is succeeded as general manager, Western routes, by Mr. J. Ross Stainton, who has previously been general manager, Eastern routes. Mr. Basil W. Bampfylde, at present with B.O.A.C. Associated Companies, Ltd., becomes general manager, Eastern routes.

AVRO AWARDS.—Seen at the annual apprentice day of A. V. Roe and Co., Ltd., on January 2, is Air Marshal Sir Geoffrey W. Tuttle, K.B.E., C.B., D.F.C., Deputy C.A.S. (second from right). With him, left to right, are John A. Kendall, (Freddie Bassett Trophy); Philip E. Hall (504 Club Trophy), and John Wolstencroft (Roy Chadwick Memorial Award).

FEDERATION PRESIDENT.—Mr. Lewis Chapman, chairman of William Jessop and Sons, Ltd., of Sheffield, is the new president of the British Iron and Steel Federation.

MR. R. MOXHAM.—We regret to record that Mr. R. Moxham, manager of the General Electric Co.'s factory at Broad Oak, Portsmouth, since 1954, died on December 25. He was 50. He had been with the company since 1933, and six years later became chief inspector of the Radio Communications Group at Coventry. During the War he worked on the development of VHF equipment.

MR. E. A. BELDAM.—We regret to record that Mr. Ernest A. Beldam, M.I.Mar.E., senior director of Beldam Asbestos Co., Ltd., and Auto-Klean Strainers, Ltd., died on December 25.

INDIAN POST.—Dr. O. P. Mediratta, M.A., B.Sc., Ph.D., A.F.R.Ae.S., until recently head of the guidance and control department, guided weapons, at Short Brothers and Harland, Belfast, has left to become deputy director (research and development) at the Directorate of Technical Development and Production (Air), Ministry of Defence, Indian Government, in New Delhi.

Dr. O. P. Mediratta, whose new appointment is noted above.

AIRCRAFT EMPLOYMENT.—The Ministry of Labour has announced that the number of people employed in "the manufacture and repair of aircraft" during October was 246,900. This compares with 259,000 in October, 1957, and 263,800 in October, 1956.

Military Aviation Affairs

AIR DEFENCE GAP.—Following the recent arrival of a Cuban Air Force B-26 in Miami, after flying unchallenged for 300 miles up the coast of Florida, and passing within striking distance of Cape Canaveral, the Atlantic Air Defence Identification Zone is to be extended into the Gulf of Mexico. Hitherto air-defence radar and interceptors have been arranged mostly in North America, to face the greatest threat.

R.A.F. RESERVES. — The R.A.F. Reserves Club Ball is to be held at the Dorchester Hotel, Park Lane, London, on February 25, 1959. Tickets, price 37s. 6d. each, and table reservations are available from the club secretary, 14 South Street, London, W.1.

MORE HILLERS.—Another order for the Hiller H-23D Raven three-seat helicopter has been placed by the U.S. Army, this time for 116. Last June 108 were ordered.

NATO MISSILE UNITS. — Gen. Norstad, Supreme Commander, Allied Forces Central Europe, has stated that he now has 30-40 missile battalions under his command. This number is to be increased to more than 100 surface-to-surface battalions within two-three years, with additional units to operate SAMs.

OVERSEAS TOUR.—The Chief of the Air Staff, Marshal of the R.A.F. Sir Dermot Boyle, left R.A.F. Binbrook on January 10 on a 20,000-mile tour of R.A.F. overseas units. He is piloting himself in a Bomber Command Canberra.

DANISH SIDEWINDERS.—Two R. Danish A.F. fighter squadrons operating F-86 Sabres at Aalborg are to be equipped with Sidewinder AAMs. These will be the first Danish units to receive the American missiles.

MORE S-58s.—The Sikorsky Aircraft Division of the United Aircraft Corpn. has received a U.S. Navy contract, worth about $35 million, for further production of the Navy and Marine Corps versions of the S-58 helicopter—the HSS-1N anti-submarine aircraft and the HUS-1 for troop and cargo transport.

R.A.F. CONCERT. — The fourth R.A.F. anniversary concert, commemorating the formation of the Service, will be held at the Royal Festival Hall, London, on April 14, 1959. As in previous years, the programme will be given by the Hallé Orchestra and the Central Band of the R.A.F.

U.S. EXPORT.—One of the 10 Martin P5M-2 Marlin anti-submarine flying-boats for the French Navy. The first was delivered on January 9.

Private Flying

H.J.C.'s CLUB COMMENTARY

● WITH the sudden death of Mr. Ernest Milner-Haigh, who, as reported in our issue of December 5, had made a successful tender to the Air Ministry for the purchase of Perranporth Aerodrome, the future of the aerodrome and of the **Cornish Gliding (and Flying) Club** seemed to be in doubt. It is pleasing, therefore, to record that Mr. Charles Milner-Haigh, son of the deceased, has announced that his father's death will not alter their original plans and that the position regarding the sale is unchanged.

The intention is to preserve the aerodrome for the use of the club, and also to make it available for private and charter aircraft, with its eventual full-scale development if there is enough interest in the county.

The deposit on the aerodrome has been paid, and the final conveyance is due to be completed on March 5.

Mr. E. Milner-Haigh died on December 28, having apparently been struck by a train on a crossing near his home at Carbis Bay. He was a well-known and popular figure in St. Ives, and had always shown the greatest interest in the activities of the club of which his son is a joint honorary secretary.

● TO COMMEMORATE the work of Miss Jean Bird, who was killed in a flying accident at Manchester in 1957, a new trophy is to be awarded each year to a British woman pilot who has achieved a noteworthy performance in aviation.

Candidates for the Jean Lennox Bird Trophy must hold at least an S.P.L. or a "B" gliding certificate. Achievements to be considered can be one event or a series, such as rapid training progress, completion of a difficult flight and so on, so that the trophy may be won by an inexperienced pilot or an experienced one. Closing date for nominations is January 31; the address, 71 Vale Road, Worcester Park.

The award committee consists of Lord Brabazon, Lady du Cros, M. O. Imray (R.Ae.C.), Capt. O. P. Jones (G.A.P.A.N.), Miss Allison King (B.W.P.A.), Alan Sproxton (A.B.A.C.) and Philip Wills.

This new trophy should not be confused with the Jean Bird Memorial Cup, awarded by the Experimental Flying Group.

● THE amount of flying at the **Oxford Aeroplane Club** at Kidlington in December was not, according to the club's newsletter, exceptional, but was roughly up to the corresponding period of 1957. Members seem to be taking more interest in advanced flying, particularly instrument flying, and to this end a Proctor 3, G-AOEJ is being added to the aircraft fleet. This is in fact the aircraft in which Wg. Cdr. Bob McIntosh finished second in the last King's Cup race at Coventry.

● C.F.I. of the **Plymouth Aero Club**, Mr. Philip Cleife, reports that in the last three months flying showed an increase of 95 hr. over the corresponding period of 1957. Individual monthly totals were: October, 284 hr.; November, 217 hr., and December, 176 hr.

First solos have been flown by Cdt. Sgt. I. C. J. Hughes and Mid. R. N. Partington; first night solos by C. Suter, M. Griffiths, A. Elsener and A. Prive.

Howard Levy photograph

MIDGET SPORTS.—This Guether Special owned by Bud Purnell of West Chester, Pa., and named the "Angel Kitten," has an 85-h.p. Continental engine. It weighs 880 lb. loaded, has a span of 16 ft., and does 160 m.p.h.

One of the staff members, Dick Gliddon, now has a night rating and is qualified for night instruction. Mr. Stanley White, the control officer, left in the autumn and has been replaced by Eval Wilson.

An Auster J.1.N. Alpha, G-AJUL (Gipsy-Major powered), has been added to the Plymouth fleet.

● MR. MAURICE L. LOOKER, formerly chief flying instructor of the Puffin Aero Club at Chivenor, now holds a similar post with the **Coventry Aeroplane Club.**

● WE regret to record that Mr. Norman W. Nash, one of the founder-members of the Cardiff Aeroplane Club, died on December 25 after a short illness. He was 71.

Gliding Notes

by Dr. A. E. Slater

WHEN the Midland Gliding Club's "wave safari" meeting started just after Christmas there had been no west wind blowing up the Long Mynd for six weeks, so it was time something happened—and it did, with a vengeance, for on December 27 a west wind of more than 50 knots was registered by the anemometer on the clubhouse roof, and it even stayed at 60 knots (69 m.p.h.) for a whole hour. Fifteen pairs of strong arms were needed to hold on to each machine as it was rigged and taken to the edge of the hill, and luckily the wind was free from turbulence in spite of its strength, so take-offs could be done in good style.

From Lasham came a contingent of eight sailplanes. There was the Army Club's Eagle, and three club Skylark 2s. Privately-owned machines were the Harwoods' Skylark 3, another Skylark 3 and Skylark 2, and David Hooper's Eagle. On this day the smooth wind gave promise of waves, and the promise was fulfilled, for John Anstie, in a Midland Skylark, reached 9,800 ft., and David Hooper, with Ann Newton as passenger, 8,300 ft. But they found the wind fell off with height, for they could hover over a fixed point at only 40 knots airspeed at the top of the climb. Many others contacted the wave, but Frank Irving's Skylark was unfortunately mistaken for a club machine and signalled down just as he had contacted the wave.

Next day the wind still blew up the hill, but more moderately, and a lot of slope-soaring was done. On December 30, after a promising start, it backed to south and people trying for 5-hr. flights were let down, one of them to the bottom of the hill. But it returned to west next day and Tim Corbett of the Midland Club made 5 hr. in the Prefect, while Brian Masters climbed slowly foot by foot to 2,500 ft. in wave lift.

There were another two days of slope lift till the snow arrived on January 3; then on the 4th the Army Eagle was precariously manœuvred down the hill through the snow so as to get back to duty, though the rest of the visiting fleet was left under cover at the top for safety and may still be there.

* * *

THIS YEAR 14 gliding clubs, ranging geographically from Perranporth to Aberdeen, are offering instruction courses to non-members at an all-in fee, inclusive of flying, full board and accommodation, varying from 12 to 16 guineas. Most of the courses are between April and October, though Lasham carries on all the year round. The British Gliding Association (19 Park Lane, London, W.1) has a leaflet giving times, places and costs of all the courses.

Those thinking of taking a course can attend an "introductory lecture" at the Kronfeld Club (74 basement, Eccleston Square, near Victoria Station), at 20.00 hrs. on the first Tuesday of any month from February to September inclusive.

* * *

AT Lasham's Christmas party we heard one of the best gliding songs yet produced: a parody of "The Twelve Days of Christmas," sung by "The Two Bills" to their guitars and written by Bill Wills' wife. The simple first verse was "On the first day of Lasham my instructor said to me: keep it floating as long as you can." But by the 12th day the instructor's patter had received a good deal more than 12 additions, and all I could get down was: "Put the nose down, pull the knob twice, look round first, turn to the left, don't forget the rudder, keep the nose up, watch the horizon, look there's Harting, let's try a stall, increase your speed, ignore the altimeter, hand on the brake (this is the *lento* line), straighten up now, wings level, look well ahead, keep it floating. . . ."

On the notice-board was a list of officials, already chosen for the 1959 National Championships, to be held from May 9 to 18. The stewards are to be Mrs. Alex Orde, F. N. Slingsby and I. de F. Thompson; chief marshal, John Archer; tug manager, Dave Darbishire; controllers, Sidney Swallow and Valerie Crown; chief despatcher, Peter Hampton; publicity officer, Anne Ince; press relations, Bob Pirie; secretary, Lyn Boucher.

At the party was an airline pilot who, the previous day, had encountered curious vertical currents while crossing Mont Blanc at 22,500 ft. against a very strong N.W. wind. Directly above the summit was a stationary lenticular cloud. Approaching this over the lee side of the mountain, he got lift at 1,000 ft./min.; but then, over the windward side, he encountered 1,000 ft./min. sink. So, 7,000 ft. above the top, the usual vertical air flow was reversed. So much for the old theory that "hill lift" continues upwards over the windward face to three times the height of the "hill."

On an earlier occasion, flying a Dakota from south to north against the wind over Corsica, the flow was more conventional in direction, if somewhat violent, for he got 2,000 ft./min. sink in the lee of the mountains, but 1,000 ft./min. lift on leaving the north tip of the island.

Correspondence

Looking Ahead in "The Aeroplane"

AT a time when VTOL aircraft have so clearly come to stay, it is worth noting that some of the problems such aircraft overcome were already considered of great importance long before the War by your provocative and far-sighted predecessor, C. G. Grey.

Throughout the period between the Wars he was frequently critical of the danger of aircraft which landed too fast and took too long to stagger off the ground. (See as early as THE AEROPLANE, Vol. XXII, 1922, p. 381.*) In 1939 he was already demanding an aeroplane able to "drop vertically under full lateral control." (THE AEROPLANE, Vol. LVI, 1939, p. 63.†) Not until we possess such a machine, he said, would air transport be safe and really successful.

C.G.G.'s predictions have not always come to pass, but many of them have. Let us hope that this will be one of them.

Scraptoft, Leicestershire. E. BIRKHEAD.

[* C.G.G. wrote: "Nor do we like machines which may have to land at 70 miles an hour on rough ground or among trees when we know that it is possible to build a machine which can be brought down as slowly as a parachute. Nor do we like machines which need a run of several hundreds of yards and thereafter can barely scrape over house-tops when we know that variable camber wings can be fitted which will lift them in a few yards."

†C.G.G. wrote: "When the World's Governments insist on having warplanes which will not whip-stall into a spin, and will not burn up after a crack up, Air Transport aeroplanes may also become reasonably safe and reliable. But apparently the organizers of Air Transport are less concerned about their passengers than Governments are likely to be about their pilots and crews.

"Obviously war-pilots and crews cost a lot to train, and politicians will need a lot of pilots and crews to protect their own skins. And the supply of pilots who are up to the best air-line standards is limited, whereas passengers cost nothing, and the supply is unlimited—or so air lines seem to think, as they turn them away. So the flying of Air Force aeroplanes of all nations must be simplified and the quality of pilots must be sacrificed to quantity. Thus, apparently, we may arrive at safe civil aeroplanes because war-pilots are considered valuable."—ED.]

Those Vicious Attacks

I HAVE been reading, in your recent editions, the vicious attacks launched upon Her Majesty's Government in the Editorial.

While I cannot help agreeing with the idea of a better co-ordination between the various Ministries concerned, I do feel that the criticisms are somewhat short-sighted. The Government have other things on which they must spend their money. (For example, State education, and all the other apparatus for spoon-feeding the "starving masses.") Our Government suffers from the unfortunate predicament of being dependent upon a rather fickle population.

Alderley Edge, Cheshire. BAGSHAW H. HOUGHTON.

Polar Pioneers

I WAS most interested to see the letter from Mr. J. H. Davis in your issue of January 2 regarding Sir Douglas Mawson and the Vickers monoplane which he took with him to the Antarctic in 1911. During recent years I have carried out extensive investigations into the early aviation history of Vickers and the following notes amplifying the details given by Mr. Davis may be of interest.

This Vickers monoplane No. 1, the first heavier-than-air machine built by the company, was completed at the Erith Works in July, 1911. It was based upon the R.E.P. design but differed in several respects, especially as regards the undercarriage. Many components for this first aircraft were, however, imported from France and the engine fitted with a French-built 60 h.p. R.E.P. five-cylinder semi-radial (not a three-cylinder Anzani as Mr. Davis believed). One of the fitters who built this aircraft, Mr. H. F. Field, was still in the employment of Vickers-Armstrongs (Engineers), Ltd., at Crayford until only six months ago.

In 1956 I was in touch with Sir Douglas Mawson, who recalled that on his return to this country at the end of the Expedition he brought back with him the seized-up engine and presented it to Vickers. Unfortunately there is no record of what happened to this interesting relic, but it was probably lost during the rapid expansion of the company in the First World War or during the equally rapid contraction immediately afterwards.

The fuselage was left behind in the Antarctic at the Expedition's winter base at Cape Denison, where, Sir Douglas informed me, it still remains and has been seen by several subsequent expeditions. It is reported to be in excellent condition, undoubtedly owing to its metal construction.

Westminster, London, S.W.1. H. E. SCROPE.

Messier Facts

MY attention has been drawn to the statement on p. 23 of THE AEROPLANE, January 2, to the effect that the British Messier Company sprang from Messier Aircraft Equipment, Ltd.

This is not correct. Messier Aircraft Equipment was the former name of Electro-Hydraulics at the time when we held a restrictive patent licence from the French Messier Company. The British Messier Company was not formed until after we had terminated our licence from the French company and therefore did not spring from us.

Electro-Hydraulics, as you know, have developed considerably from that date and we are currently responsible for the design and manufacture of undercarriages and hydraulic equipment on the Handley Page Victor and Herald, the Hunting Prince and Pembroke, and the Scottish Aviation Twin Pioneer, of the main undercarriages on the Avro Shackleton Mk. 3, of the hydraulic equipment on the Blackburn NA.39 and the Supermarine Scimitar, and also for the manufacture of undercarriages for the Scimitar and the English Electric Canberra.

Warrington, Lancs. CHARLES SHARP, Electro-Hydraulics, Ltd.

Groundabout

Degree of Negativity. Those who were sure that the Russians *did* aim their "probe" rocket at the Moon are supported by the implication of a cable sent to Washington from Moscow. It goes: "ANYTHING YOU CAN'T DO WE CAN'T DO BETTER."

*

Everybody His Own Executive. When Juan Trippe, president of Pan American, was asked by his captains for as much as $45,000 annual pay, he is said to have commented, "This will give me 900 new vice-presidents."

*

But the undeniable fact that things are not quite like they were, was brought home when a P.R.O. told me sadly that he was even running out of cigars *at home!*

*

Nothing to do with the above. "He's what we call a double-bass man—he's got the biggest fiddle in the place."

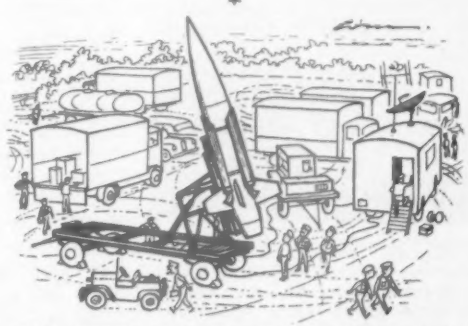
*

"Listen, my boy, the only way to make this airline pay is by hard work or by using mirrors—and we're fresh out of mirrors."

*

"The best thing about getting to New York in ten hours is that you can be back in London in twenty hours."—"*Jed*" *Williams, Britannia Operations Consultant.*

*



"Well, I only hope that if ever it *is* fired it damn' well *hits* something . . ."

by Gren

NOTES AND EVENTS

SURRENDER CALLS.—Sound equipment manufactured by The General Electric Co., Ltd., has been used throughout the Malayan anti-terrorist campaign, and a Bristol Sycamore, its crew, and loudspeaker units are seen about to depart on a mission from Ipoh. The helicopter flies to a prepared clearing in deep jungle, where the equipment is set up to broadcast in the believed direction of terrorists.

CARAVELLE SIMULATOR.—S.A.S. has ordered a Caravelle flight simulator from Redifon, Ltd., of Crawley, Sussex. The simulator, which is to be installed in the airline's new simulator hall in Stockholm, will be used for training S.A.S. and Swissair crews.

BRISTOL POWERED.—The first of two new "Brave" class fast patrol boats for the Royal Navy—H.M.S. "Brave Borderer"—built to joint Admiralty/Vosper design, is powered by three Marine Proteus gas turbines designed and manufactured by Bristol Aero-Engines, Ltd.

YARD AND POUND.—The standards laboratories of Canada, New Zealand, the U.S., South Africa, Australia and the U.K. have agreed to adopt an international yard and pound for measurements in science and technology. Coming into effect on July 1, 1959, the international yard will equal 0.9144 metre and the international pound will equal 0.45359237 kg.

REFUELLING TENDER. — An Esso lubricating oil/water methanol refuelling tender at London Airport. Based on a Karrier Bantam chassis, the vehicle has a tankage capacity for 250 gal. of oil and 150 gal. of water methanol. To ensure adequate viscosity in cold weather, the tank is covered with electric blankets.

BALLOON NAVIGATION. — Kelvin and Hughes navigational instruments were carried in the balloon "The Small World" during its 3,000-mile crossing of the Atlantic. These consisted of an aircraft compass and aircraft sextant, and a lightweight marine sextant.

R.Ae.C. FILM SHOW.—Mr. William Courtenay, O.B.E., M.M., is to give a film programme in the R.Ae.C. Library, 19 Park Lane, London, W.1, at 18.15 hrs. on January 19. Members and associate members of the club and their guests are welcome.

PLASTICS EXTRUSION.—The Plastics Extrusion Division of Hellermann, Ltd., Crawley, Sussex, has recently published a booklet entitled "An Insight into Plastics Extrusion." It describes the Division's progress and expansion into this field.

Company Notices

NEW COMPANIES

Aero-Enterprises (Boreham Wood), Ltd. (617,232). Private co. Reg. Dec. 22. Cap. £5,000 in £1 shs. Objects: To carry on the business of agents for and dealers in aeroplanes, seaplanes, etc. Subscribers (each with one sh.): George A. Crook, 51 Caversham Avenue, London, N.13, company director; Emily Faulkner, 15-17 Chichester Rents, Chancery Lane, London, W.C.2, clerk. Directors: James H. Stevens and Esme M. Stevens. Sec.: George A. Crook.

Bristol Aerojet, Ltd. (617,031).—Private co. Reg. Dec. 18. Cap. £100 in £1 shs. Objects: To carry on the business of inventors, designers and manufacturers of and dealers in guided missiles, rocket motors and fuels therefor, propulsion units, aero, marine, motor, stationary and other engines of all kinds; airframes of all kinds, aircraft and other flying machines, etc. Subscribers (each with one sh.): Richard J. Beaven and John D. Taylor, solicitors, both of 42 Gracechurch Street, London, E.C.3. First directors not named. The Bristol Aeroplane Co., Ltd., and Aerojet General Corpn. shall each be entitled to nominate one-half of the directors. Solrs.: Stanley and Co., 42 Gracechurch Street, London, E.C.3. Reg. off.: Stonebridge House, Colston Avenue, Bristol, 1.

Claydon Aviation, Ltd. (616,902).—Private co. Reg. Dec. 16. Cap. £5,000 in £1 shs. Objects: To carry on the business of proprietors, operators and charterers of and dealers in aeroplanes, etc. Subscribers (each with one sh.): Cyril G. Claydon, company director, and Shirley I. Claydon, company secretary, both of 236 Old Bedford Road, Luton. Cyril G. Claydon is first director. Sec.: Shirley I. Claydon. Reg. off.: 236 Old Bedford Road, Luton.

Shaw Slingsby Trust, Ltd. (617,543). — Reg. Dec. 24 as a company limited by guarantee without sh. cap. Original number of members, seven, each being liable for £10 in the event of winding up. Objects: To promote aerial transport and communications in the United Kingdom by the study and practice of gliding and soaring flight, etc. Income and property of the Association, whencesoever derived, shall be applied solely towards the promotion of its objects. Management vested in a council, first members of which are: Philip A. Wills, Epworth House, 25-35 City Road, London, E.C.1; Basil J. G. Meads, Stonycroft, London Road, Alderley Edge, Ches; Eric J. Furlong, "Greet," Mottingham Lane, London, S.E.9. Solrs.: Beaumont and Son, London, E.C.2. Reg. off.: Epworth House, 25-35 City Road, London, E.C.1.

INCREASE OF CAPITAL

Southern Apparatus Co., Ltd. (489,317).—Precision and aircraft engineers, etc. The Centre, Commercial Road, Totton, Southampton. Increased by £7,000 in £1 Ordinary shs., beyond reg. cap. of £13,000.

New Patents

APPLICATIONS ACCEPTED

809,278.—Bendix Aviation Corpn.—"Aircraft control system."—Nov. 16, 1956 (Dec. 19, 1955).

809,150.—Rolls-Royce, Ltd.—"Aircraft structures."—Dec. 14, 1955 (Dec. 14, 1954).

809,201.—Wibault, M. H. M. J.—"Jet-propelled aircraft."—Jan. 3, 1956 (Jan. 12, 1955, and Dec. 29, 1955).

809,260.—British Messier, Ltd.—"Undercarriages for aircraft."—April 30, 1957 (April 30, 1956).

Applications open for inspection on Feb. 18, 1959; opposition period expires on May 18, 1959.

809,608.—Curtiss-Wright Corp.—"Aircraft static pressure simulating system."—April 17, 1956 (April 22, 1955).

Application open to public inspection on Feb. 25, 1959; opposition period expires on May 25, 1959.

Aviation Calendar

January 17.—Aircraft Recognition Society, All-England Aircraft Recognition contest, at the Royal Society of Arts, 6 John Adam Street, **London,** W.C.2.

January 19.—R.Ae.C., film show by William Courtenay, at 19 Park Lane, **London,** W.1, at 18.15 hrs.

January 20.—R.Ae.S. Luton Branch, Junior Paper Evening, in the Napier senior staff canteen, **Luton Airport,** at 18.15 hrs.

January 21.—Institute of Metals, Manchester Metallurgical Society lecture, "The Investigation of Metallurgical Failures in Aircraft," by D. A. Ryder, at the Central Library, **Manchester,** at 18.30 hrs.

January 22.—R.Ae.S. Bristol Branch lecture, "Guided Missiles—I," at Filton House, **Bristol,** at 18.00 hrs.

January 22.—R.Ae.S. Isle of Wight Branch lecture, "Nuclear Propulsion of Aircraft" by J. V. Dunworth, at the Saunders-Roe Sports and Social Club, Church Path, **East Cowes,** at 18.00 hrs.

January 22.—R.Ae.S. Southend Branch lecture, "Modern Aircraft Production Methods," in the Labour Hall, Boston Avenue, **Southend,** at 19.30 hrs.

January 26.—R.Ae.S. Halton Branch lecture, "The Beverley in Service," by Gp. Capt. F. C. Griffiths, at the Branch H.Q., R.A.F. **Halton,** at 18.45 hrs.

January 26-29.—Institute of the Aeronautical Sciences, 27th Annual Meeting, at the Hotel Astor, **New York,** U.S.A.

January 27.—R.Ae.S. lecture, "Some Aspects of the Engine Noise Problem," by P. Lloyd, in the library, 4 Hamilton Place, **London,** W.1, at 19.00 hrs.

January 28.—R.Ae.S. Southampton Branch lecture, "Recent Developments in Noise Suppression," by Prof. E. J. Richards, in the Institute of Education, University of **Southampton,** at 20.00 hrs.

January 28.—R.Ae.S. Weybridge Branch, film show, at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge,** at 18.10 hrs.

January 29.—R.Ae.S. Bristol Branch lecture, "Guided Missiles—II," at Filton House, **Bristol,** at 18.00 hrs.

January 29.—R.Ae.S. Preston Branch lecture, "Flying Boats," by M. J. Brennan (Saunders-Roe), in the Hewitt Lecture Room, **Lytham,** at 19.30 hrs.

January 29.—R.Ae.S. Belfast Branch lecture, "Scientific Research with High Altitude Rockets," by Dr. E. B. Armstrong, in lecture hall LG8, David Keir Building, The Queen's University, **Belfast,** at 19.00 hrs.

Personal Notices

BIRTHS

Clark.—On December 22, at R.A.F. Hospital, Akrotiri, Cyprus, to Hazel (*née* Vincent), wife of Flt. Lt. G. J. Clark—a daughter.

Reid.—On December 30, at R.A.F. Hospital, Nocton Hall, to Margaret, wife of Sqn. Ldr. A. G. Reid, R.A.F.—a daughter.

Smith.—On December 22, at Awali Hospital, Bahrein, to Patricia, wife of Sqn. Ldr. L. G. (Peter) Smith, D.F.C., D.F.M.—a daughter.

Swanborough.—On January 2, at Hayes, Kent, to Marion, wife of F. G. Swanborough, of THE AEROPLANE—a son (Stephen Paul).

Taylor.—On January 2, at R.A.F. Hospital, Halton, to Margaret, wife of Sqn. Ldr. T. H. Taylor—a son.

MARRIAGE

King—Tours.—On December 20, at Holy Trinity, Northwood, Lieut. J. G. King, R.N., to Gay Tours.

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* *See page 27 for answer.*

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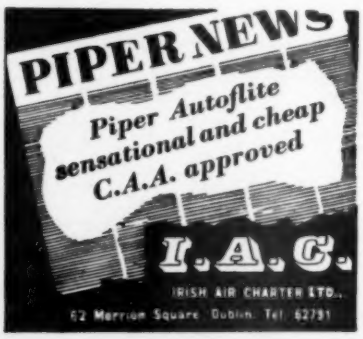

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MISCELLANEOUS

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NOTICES

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FROM EAGLE AIRWAYS, LTD., OF 40 EDGWARE ROAD, LONDON, W.2:—

APPLICATION NO. 1042/3 for an amendment to the terms of approval of the seasonal Normal Scheduled Service which they are authorized to operate with Viking and/or Viscount aircraft on the route London Airport and/or London (Blackbushe)-Lyons (opt. tech.)-Pisa at a frequency of four return flights weekly from March to October each year until October 31, 1964, and on which they have previously applied to operate DC6A/B aircraft in addition to the types already authorized, so as now to permit them to operate on the route London Airport and/or London (Blackbushe)-Lyons (opt. tech.)-Pisa and/or Florence.

FROM EAGLE AVIATION, LTD., OF 40 EDGWARE ROAD, LONDON, W.2:—

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INDEX TO ADVERTISERS

Name	Page
A	
Aer Lingus	25
Amphenol (Great Britain), Ltd.	22
Armstrong Whitworth, Sir W. G., Aircraft, Ltd.	11
Atlas Copco AB/Sweden	21
B	
Boeing Airplane Co.	3
Boulton Paul Aircraft Ltd.	Inside Back Cover
B.P. Aviation Service	18
Bristol-Siddeley Engines, Ltd.,	Back Cover
British Aviation Insurance Co., Ltd., The	28
British Institute of Engineering Technology	27
British Oxygen Arc Equipment, Ltd.	2
C	
Central Office of Information—Royal Air Force Recruiting	26
Cross Manufacturing Co. (1938), Ltd.	26
D	
De Havilland Engine Co., Ltd., The	Front Cover
Delaney Gallay, Ltd.	13
E	
Elliott Brothers (London), Ltd.	26
F	
Fairey Aviation Co., Ltd., The	8
Flexello Castors & Wheels, Ltd.	28
G	
Garrett Corporation, The	5
General Electric Co., Ltd., The	23
Goodyear Tyre & Rubber Co. (Great Britain), Ltd., The	10
H	
Hawker Siddeley Group	27
Hymatic Engineering Co., Ltd., The	7
I	
I.C.I., Ltd. (Plastics Division)	4
International Aeradio, Ltd.	27
Irish Air Charter, Ltd.	24
K	
Kelvin & Hughes, Ltd.	27
L	
London School of Air Navigation, Ltd.	24
M	
Marconi's Wireless Telegraph Co., Ltd.	12
Miles Electronics, Ltd.	19
O	
Omnipol Ltd.	22
R	
Roe, A. V., & Co., Ltd.	17
Rolls-Royce, Ltd.	14 & 15
Rotax, Ltd.	Inside Front Cover
Rozalex, Ltd.	26
S	
Scottish Aviation, Ltd.	16
Shackleton, W. S., Ltd.	24
Short Brothers & Harland, Ltd.	1
Skate Express 555	20
T	
Teddington Aircraft Controls, Ltd.	23 & 27
U	
United Kingdom Atomic Energy Authority—Harwell	25
V	
Vaughan, Edgar, & Co., Ltd.	6
Vickers-Armstrongs (Aircraft), Ltd.	9

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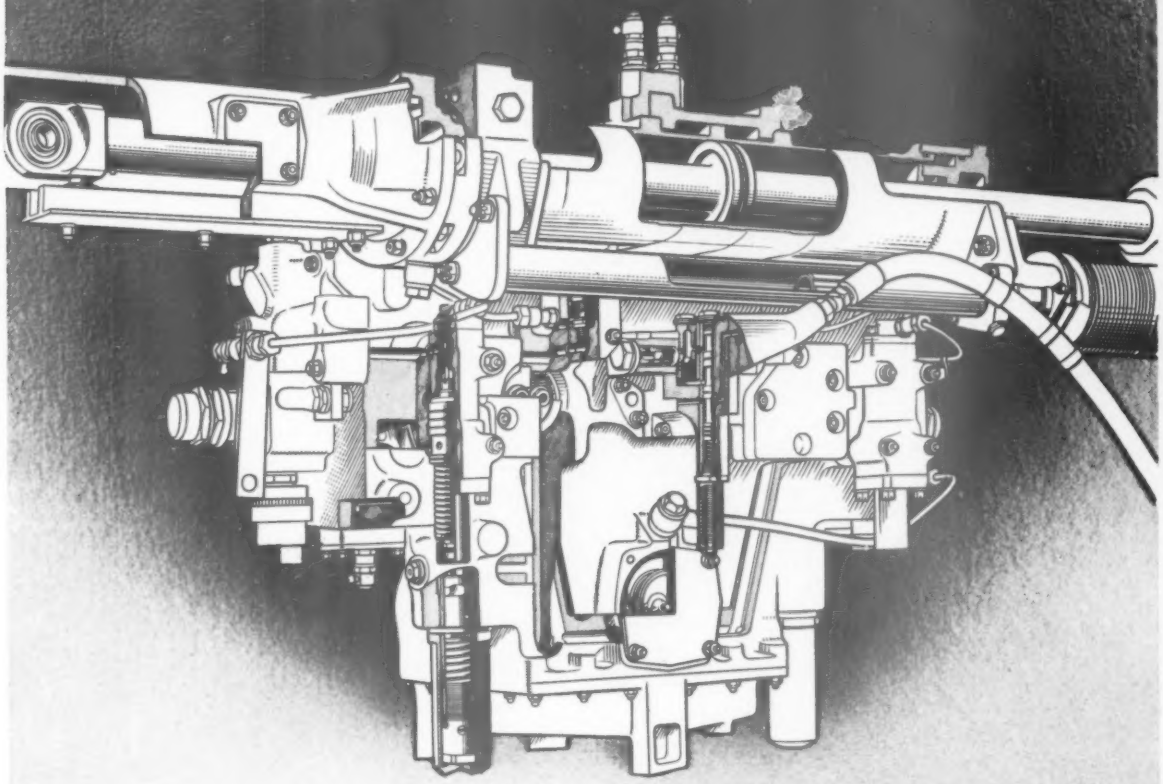

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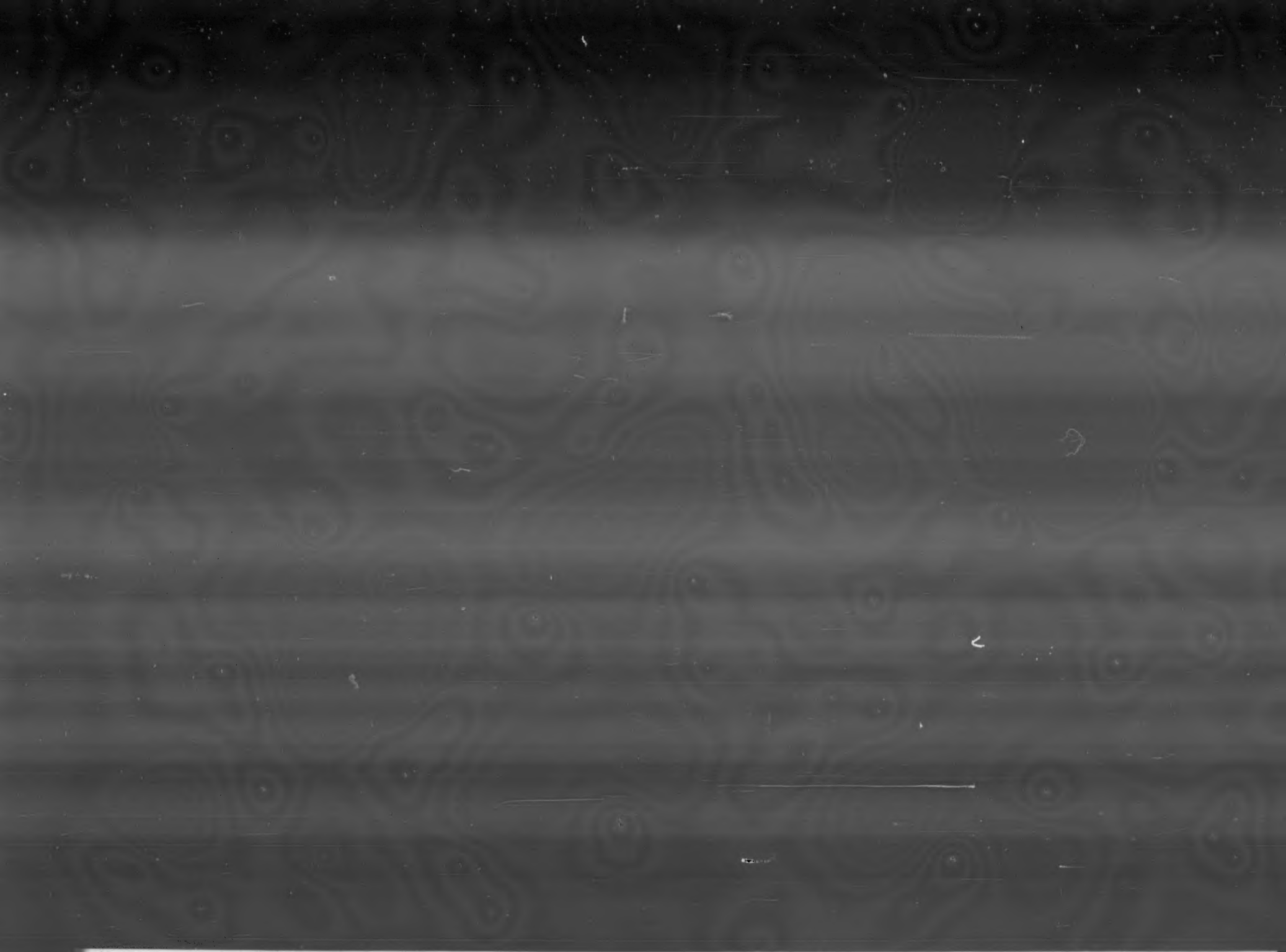
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